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The Geographical Journal

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A CONTRIBUTION TO THE GEOGRAPHY OF MACEDONIA

Alan G. Ogilvie, O.B.E.

Read at the Meeting of the Society, 24 March 1919. Map following p. 72.

A THOROUGH geographical study of southern Macedonia would amply repay the work expended upon it, whether the practical results be sought which would accrue from a clear view of the country's economic future, or whether the aim be more academic, in regarding the region as good ground on which to test the application of geographical reasoning. In Macedonia the present shape and aspect of the country, the climate of the region, the condition of its vegetable cover, the nature of its fauna, the manner of life and state of health of its human inhabitants, are all physical circumstances which act the one on the other with peculiar vigour. In other words, the geographic controls are here remarkably strong.

In the present paper I can attempt no more than a suggestion in most of the topics dealt with. The contribution is based upon impressions rather than on thorough investigation, since the main object of my recent stay in Macedonia was not strictly geographical; and some of the impressions may require revision at a subsequent date. In dealing successively with the various physical circumstances of the region the conventional order * will be followed; but it must not be forgotten that the influences of the various geographical elements are reciprocal. The paper treats only of the section of Macedonia recently occupied by the British Army. Its area is about 10,000 square kilometres (3800 square miles), or roughly equal to the counties of Devon and Cornwall.

The geological facts essential to the geography of Macedonia may be summarized as follows:—

1. It is an area primarily of crystalline metamorphic rocks, arranged for the most part in folds parallel to those of the Dinaric Alps (*i.e.* north-west to south-east), but showing in places traces of cross folding (north-east to south-west) (see Fig. 1).

2. A long period of denudation contemporaneous with and subsequent

* Geological and structural considerations, land forms, vegetation, fauna, man, man's life.

to the folding produced on the crystalline rocks a surface of low relief in which only the most resistant rocks—generally the crystalline limestones —still formed abrupt ridges. This crystalline land-surface extended far to the south over what is now the Ægean Sea.

3. A gradual subsidence of the worn land-surface, and changes in surrounding districts, led to the flooding of most of the region by the waters of a wide fresh-water lake known to geologists as the Sarmatic sea.

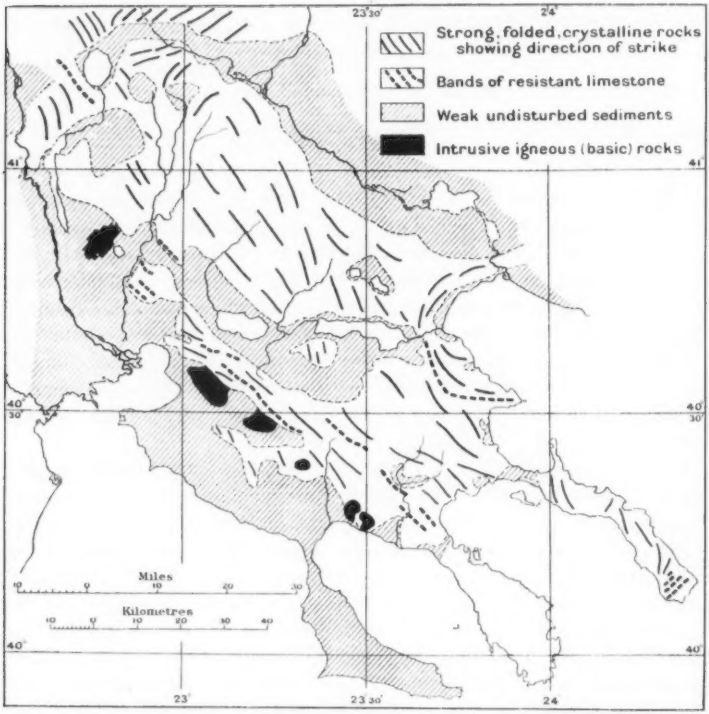


FIG. 1.—SKETCH DIAGRAM OF THE GEOLOGY OF THE AREA

It extended northwards to meet the "Pannonian lake" of Hungary, and eastwards along what is now the north Ægean coast towards the present Black Sea area.

4. Important crustal movements resulted in dislocations throughout Macedonia, so that large blocks of crystalline rock—some of them by this time covered by lake deposits—bounded by great faults, rose and sank much like the slabs of a badly laid pavement. These crustal blocks were of all dimensions, and the amounts of their vertical movement varied

greatly. The most violent as well as the latest of these movements was that which broke up the southern area, that foundered and was covered by the Ægean Sea.

5. The shape of the crustal blocks conforms to the pattern imposed to a large extent by the directions of the earlier folding, north-west to south-east and north-east to south-west faults predominating. The conflict of these two systems of rock folds seems previously to have weakened the

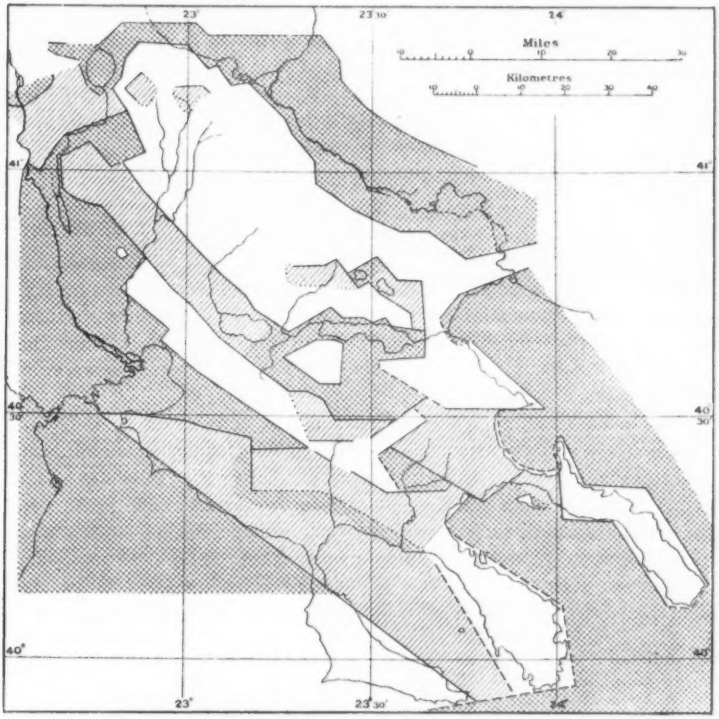


FIG. 2.—CHIEF AREAS OF COASTAL SUBSIDENCE

Areas are bounded by geological faults, proved or probable. Shading indicates areas depressed relative to surrounding blocks. Depth of shading does not show the amount of subsidence

crust and to have determined the subsidence of such areas as the Doiran and Butkova basins and the Gulfs of Orfano and Erissos (see Fig. 2).

6. The dislocations were associated with igneous intrusions, mainly by basic rock, and with the formation of metalliferous veins in the neighbourhood of the faults.

7. The land thus divided into high blocks and low blocks became gradually drained. The foundering of the Ægean blocks had withdrawn

the southern lip of the Sarmatic Lake, which consequently ceased to exist. But fresh water lay in all the newly formed basins, and the drying process is not yet complete. Most of the low plains of our region are still covered by shallow lakes.

In view of such geological facts and of the recent geological period (late Tertiary–Quaternary) at which they took place, it is not surprising that they are strikingly reflected in the relief.

Land Forms.

The region is chiefly remarkable for its isolated plateaus, representing those parts of an old denuded surface which have stood firm or been slightly raised, and for its flat plains surrounding the plateaus and representing the parts which have sunk. The uplands are bounded by remarkably straight and abrupt sides—the faultscarps—overlooking the plains. The even plateau surfaces are broken by the residual ridges, such as the long limestone crest of the Khortach Dagh, and by the deep-cut ravines which since the formation of the surrounding basins have been dissecting the ancient surface. This fresh dissection, however, still leaves several tracts quite untouched. The faultscarps remain much indented by the mouths of the ravines; but the steep spurs between them show by their alignment the course of the underlying fault, while the position of this fracture is often farther emphasized by a line of warm or mineral springs.

The main features of the relief, then, are determined by the long denudation described in (2) above and the crustal dislocations in (4). The strike of the rocks, while it is often parallel to the faults, has so far exercised only a minor direct influence upon the relief. The ravines on the plateau surfaces show a tendency to follow the weaker strata either along the strike or on some fracture line. Some of the most important hill masses, such as the Belashitsa and Kholomon, do not follow the direction of the strike, their trend being dependent on the fracture lines.

The significance of the distribution of rocks (Fig. 1) in relation to the relief (*v.* Map) will now be understood. The crystalline rocks—gneiss, schists, limestone and a much-altered granite—occupy all the higher parts of the region, while the areas of subsidence (Fig. 2) correspond closely either with the unaltered sedimentary rocks or with the sea. Sharp contrasts of relief correspond for the most part with the main fracture lines, and the long and abrupt coasts of the Khalkidhike are but the broken edges of its plateaus.

The chief crustal blocks compose upland areas. The Belashitsa Planina, which overlooks the region on the north, is remarkably straight and unbroken, and the steep-fronted spurs are in alignment (Plate 1). The more gentle slopes by which the spurs meet the main ridge probably represent part of the old land surface. The mountain torrents of this range are powerful agents of erosion, and the bigger ravines open on the im-

1. BELASHITSA MOUNTAINS FROM THE SOUTH, STRUMA-VARDAR WATER-PARTING, IRRIGATION ON FANS, DECIDUOUS BUSH

2. KHORTACH RIDGE WITH GALÁTISTA AND ITS BASIN FROM SOUTH-EAST

3. KHOLOMON MOUNTAINS FROM WEST; DISSECTED PLATEAU AND TRANSVERSE GORGE (RESITNIK DERE); "PSEUDOMACCHIA" AND INTERMITTENT AGRICULTURE.

mense alluvial fans. It is noticeable that while the large torrents which have made the fans still run on their surface, the much feebler and smaller intermittent streams which tumble from the spurs, having no load to deposit, have incised their beds in the soft strata between the fans. The rift between the Belashitsa and the next crustal block forms the important link between the Vardar and Struma valleys, which is used by the railway.

The Krusha–Beshik uplands form a roughly triangular mass, composed of one or more crustal blocks bounded on all sides by faultscarps more or less well marked. The Krusha and Beshik ridges of it are separated by a wide gap, which I may call the Lahana saddle (from a village situated in it). This gap is probably in part river-made, and an older Struma, crossing the ridge here, may well have been the river which further to the south-east cut the Dervend col in the Khortach ridge. In both the Krusha and Beshik massifs there are small basins almost certainly initially produced by faulting. The more northerly of these—the basins of Snevtse and Rayánovo—are drained by the Galiko. The Mávrovo basin in the Beshik upland, on the other hand, has now no superficial outlet, and contains two residual lakes, Mávrovo and Landja. These are probably drained by subterranean channels leading to lake Beshik. While there are wide undulating tracts on these plateaus, the valleys are all deeply incised, and traffic across the drainage lines is much hampered and limited to bad mule-tracks. The main Salonika–Seres road, on the other hand, finds an easy route between valleys and over the Lahana saddle.

The marginal basins all show the same physical features, and they tell of the gradual reduction in size of the lakes which once filled the basins. Thus there are lake terraces more or less pronounced, each marking a stage in the dwindling of the lakes. Changing conditions of deposition in the old lakes are reflected in the soil differences of the terraces. The higher levels are generally composed of stiff red and mottled clays with occasional gravel-beds, but in places there are layers of hard fresh-water limestone. The lower—and newer—terraces are generally more sandy, and near the present lake-levels a fine alluvial soil appears. These lake terraces and alluvial tracts form most of the agricultural area; but the low-level alluvium provides the only soil in which moisture is always near the surface. The present form of the lakes is mainly due to the arrangement of alluvial fans round their margin. Ahinos is almost cut in two by a fan 2½ kilometres in radius, and the south shore of Beshik is broken by twin fans of similar radius together 8½ kilometres wide.

The largest basins of the region are either filled by the sea, as the Gulfs of Salonika, Cassandra, Athos or Agion Oros and Orfano, or are traversed and drained by the main rivers, as the Campagna of Salonika and the Lower Struma valley. The bifurcating trough of Langadhá-Beshik is drained to the east, but there is little regular outflow from it.

As these basins contain the centres of life and communications, it would seem at first sight that the direction of their drainage must be of great importance, but the fact is that in most cases the main access to the basin is not by the way of the valley leading out of it. This is accounted for by the origin of the basins themselves, viz. subsidence, and by the fact that the system existed before the basins. We have in all Macedonia an old drainage superimposed on a new topography; since the formation of the Ægean Sea and the drainage of the greater lakes the rivers have incised their beds in the rocky thresholds separating one basin from another, but have not yet had time to widen the gorges thus formed.

The Doiran basin is roughly circular and is due entirely to subsidence. It is believed to have been drained first eastward to the Struma, but later when its waters had sunk to their present level, to have been tapped by the headward erosion of a small tributary of the Vardar by which it is now drained. But the Doiran basin, both from the nature of its origin and from its present form, is quite apart from the main lines of the Vardar and Struma.

The Kilindir basin is separated from that of Doiran by a rock threshold which is trenched by the draining stream. It is widely open to the campagna of Salonika, though much of the connecting lowland is occupied by the lakes of Arjan and Amátovo. These lakes are dammed back by the deposits of the Vardar as it emerges from its last constriction in crossing the rock threshold between this plain and the Gevgeli basin to the north. This lowest gorge of the Vardar, the Tsinganska Klisura (Gipsy pass), is just wide enough to allow the railway to follow the river, so that the threshold is not a barrier to communications, although it is a hindrance. The campagna of Salonika is widely open to the sea on the south, but access to it is somewhat hindered by the marshes of the Vardar delta. The Galiko river which drains the Krusha Balkan runs to the sea along the eastern margin of this basin. The river has cut into the flat-bedded sediments which lap round the steep broken end of the Khortach Dagh, and at this point runs in a gorge, but the gorge is wide enough to carry both the road and the railway which joins Salonika to Constantinople by way of the Doiran and Struma basins.

The Langadhá–Beshik trough, although it is drained eastwards, is much more accessible from the west. At this end the threshold is gentle and is almost covered by lake deposits, so that the gap itself is occupied by agricultural land. The basin, however, is narrowed at the gap by the imposing limestone peak of Deve Kran. This sharp crag, though attached topographically to the plateau of the north side, is geologically part of the Khortach rock, its displacement being due to faulting. East of Langadhá Lake the trough forks and isolates the horst of the Ogurli plateau. The southern branch is completely occupied by the second lake terrace, and it still carries a remnant of the greater lake in the pool of Kargi. The northern branch is uninterrupted till it meets the rock threshold at the

lower end of Beshik. This barrier between the Beshik basin and that of the Rendina Gulf is trenched by the Rendina gorge, which has for a long period been the outlet of the lake to the west of it. The gradual cutting of this gorge has been marked by the sinking of the level of the lakes which it has drained. The gorge is wide enough to carry a railway, but the Turkish Government never used this obvious route, it is said, because the railway debouching on the shore would have been open to attack from the sea. The present outflow from lake Langadhá to Beshik and from Beshik to the sea is very small, and is maintained by artificial channels. The lower end of Beshik is nearly sealed by an alluvial fan on the north shore. The torrent to which the fan is due actually runs on its east side and enters the gorge without touching the lake.

A rock threshold similar to that just described separates the Rendina gulf from the Lower Struma basin, and the Struma reaches the sea by a short winding gorge. The small delta of the river south of the defile resembles that of the Spey of Scotland both in shape and in the arrangement of the old shorelines which mark its growth.

Khalkidhike contains in miniature many physical features like those described. The two main rivers are older than the present topography. The Resitnik Dere rises in the 500-metre plateau at the eastern end of the Khortach ridge. It then traverses a much higher plateau of crystalline schists cutting a deep winding gorge across the grain of the rocks (Plate 3) and finally reaches the Cassandra gulf in a wide marshy valley. This gorge is so narrow that it is not even followed by a mule-track. The eastern part of the Khalkidhike is drained south-westwards by the Miyalka, which unites its waters in the habitable basin of Keratia, but before reaching the Cassandra gulf the river traverses two massive limestone ridges in deep and impassable gorges. The basin is thus shut in on all sides.

On the south-east side of the peninsula the same phenomenon appears on a still smaller scale. The Dhevalik river—the only stream running to the Athos gulf—drains the high alluvial vale of Gomati and reaches the sea tumbling through a rocky barrier.

On the Salonika side, however, there is a basin which is easily accessible from the sea. The area of subsidence south of the Khortach ridge is "V" shaped. It is composed of the outer Vasilika basin and the inner Galátista basin at a higher level. There is a step of some 80 metres between the two, but this is no effective barrier to communication. Beyond Galátista, however, the way to central Khalkidhike is hard (Plate 2).

It will be seen then that the outstanding physical features of the region are the wide rocky plateaus, the flat clay plains of the basins, the straight abrupt scarps, and the peculiar drainage system with its alternation of wide meandering valley and deep impassable gorge. Moreover, it is easy to understand why in many cases the present drainage lines are not the main lines of communication.

Climate.

Southern Macedonia lies at the south-western extremity of the area of East European climate and at the north-eastern extremity of the area of Mediterranean climate, and it partakes of both types. In the three summer months—mid-June to mid-September—it has little wind, little or no rain, and high temperatures, *i.e.* a Mediterranean climate. In winter, generally speaking, its climate is governed by temperature and pressure conditions in eastern Europe, there is little wind and little rain, while temperatures are fairly steady though much higher than those farther into the continent. But there are big exceptions. These are produced when a slight lowering of pressure over central and eastern Europe brings the low-pressure zone covering the Mediterranean in winter a little farther north than usual. This means that the cyclonic depressions which in the winter months follow one another from west to east over the Mediterranean are allowed to pass across the Balkan Peninsula to the Black Sea. Now here, as in any region subjected to cyclonic conditions, the direction and succession of the winds in any place depends on the direction followed by the centre of the depression, while their strength depends on the pressure gradient. As in western Europe, these winter cyclones bring the rain. But in our area these storms have an important feature, that the air which travels southwards on the back of the depression is the cold winter air of eastern Europe; moreover, not only is the pressure gradient often exceedingly steep, but this air is also descending from high plateaus down funnel-like valleys. The north wind on the rear of the winter cyclones is therefore frequently of great force. The cyclones often move slowly; the gale may therefore last for two or three days in one place. Furthermore, it generally brings snow to the hills. It is this "Vardar" wind then, as much as the trying summer heat, which renders the climate difficult to support.

In the winter when these storms are not passing over Macedonia the country is under the sway of eastern Europe. This often means three or four weeks of high pressure, no rain and clear skies, mild days but cold nights, and light breezes. But a very slight alteration of the pressure distribution makes a big difference in the weather. Thus for two or three weeks in January 1917, pressure was high and there were steady easterly breezes passing along the northern Ægean coast on the southern edge of the anticyclone. The skies of the North Ægean were clear, but on the air meeting the Khalkidhike hills and rising, a permanent cover of cloud was formed, and on the air meeting the higher mountains west of the Vardar there were heavy and long-continued rains.

The transition periods of climate in late spring and early autumn are marked by heavy thunderstorms, and the rainfall of these seasons is largely due to this cause. The rainfall generally is remarkably regular at Salonika —about 2 inches monthly, in some years with only a slight reduction in the summer months and in other years complete drought.

In the height of summer the detailed weather conditions are determined first by the more sudden heating of the land than of the sea, with the consequent sea breeze every afternoon; and secondly by the very sharp contrasts of the land relief and of the alternation of bare hill surface with marsh and plain in the interior. Every afternoon huge "pillar" cumulus clouds form above the various basins and gradually rise on the up-currents. The compensating down-currents are not so obvious, but their existence has caused the greatest inconvenience to the airmen in the summer months. Another feature of the season is the poor visibility owing to the differential heating of the layers of air and resulting haze. This is in strong contrast to the high visibility of the eastern Ægean sea area.

Water Supply.

During the Allied occupation a large amount of information must have been collected regarding the sources of water in the region; but I have not had an opportunity of consulting the records. As is to be expected in a country with light rainfall and a dry summer, there are few streams which are perennial throughout their whole course. Chief among them are the Vardar, Struma and Galiko. The others in summer become mere trickles or cease to flow, being dependent on springs within the region. The volume of the Vardar and Struma, on the other hand, depends on conditions far beyond our area. These rivers are swollen in spring from the melting of the snow in the high plateaus of the peninsula, and in the autumn from the heavy rains prevailing at that season in their upper basins. The Vardar with a much larger drainage basin probably has at least twice the volume of the Struma, which has a peculiarly narrow catchment area. But this river, which drains the highest parts of the Rhodope, is liable to sudden floods from melting snow.

In the areas of crystalline rocks the springs are far apart, and most of those which are perennial are marked by villages. The gullies which dissect the terraces of sedimentary strata fringing the basins are produced almost entirely by torrents flowing fiercely after thunderstorms; but some water-bearing stratum generally has an outcrop in their beds, and these gullies therefore provide small sources of water even in summer, although the water from such springs does not run far. In the alluvial plains the water table is never far from the surface, and wells can be sunk anywhere. Geological faults are often marked by mineral springs, some of them hot. The best known hot springs are at Lutra on the fault bounding the Vasilika basin on the north, and at Langadhá on the median dislocation of the Langadhá trough.

The Vegetation.*

In discussing the vegetation of a region from the geographical standpoint we have to consider it as the chief element in the landscape, after

* See inset map.

the land-form. We have further to realize how it is affected by the land-form, by the climate and by the soil, and what part it plays in the animal and human life of the region. Furthermore, the struggle which goes on in the vegetable kingdom itself is a physiological problem with important geographical bearings.

In this region as in many others the most outstanding distinction in the natural vegetation is that of forest, bush or scrub, meadow and marsh; but here as in other lands it is difficult to say what is the natural vegetation and what has been produced with the assistance of man and animals. In countries with light rainfall where forest is destroyed by man, and flocks are allowed to roam and browse at will, the succeeding plant formation is of the scrub type. Moreover, animals by selecting their food allow some species to gain the upper hand and so change the character of the scrub. These are but two of the many processes by which the Macedonian vegetation has undoubtedly been affected by animals.

The prehistoric remains of man in the region are nearly all in village sites or tumuli in the clay belt near the sea, from which it has with some reason been assumed that the hills were originally all densely forested; and on other evidence also it seems likely that this was so.

While the primary division of the vegetation above mentioned is sufficient for some purposes it is profitable to discriminate further, for instance between types of forest and scrub, both because they provide different environments for animal life and different uses for man, and also because they have different origins and are symptomatic of differences in other geographical elements, such as climate and soil.

While we can see at work to-day most of the causes which have produced the present physical character of the vegetation, its floristic composition is explained only by the study of gradual botanical changes in the past, into which we cannot go in the present paper. But it has been shown by Adamović that in the whole area under discussion there is a combination of plant species which is typical of the Mediterranean region —a region for this purpose taken to include the Rumelian and Thracian plains. The combinations of species typical of Central Europe on the other hand just reach the limit of the area on the north.

The probable course of development of the various vegetation types may be briefly outlined as follows: The whole region was once covered in its higher parts by forest chiefly composed of oak, beech, edible chestnut and oriental hornbeam, but which in the southern fringe of the Khalkidhike was replaced by woods of Aleppo pine, and with the gradually drying lake-beds of its plains still given over to fresh-water aquatic formations. This vegetation under the combined attacks of man and his flocks and the action of erosion underwent a gradual change. On most of the slopes of the eastern part, where the rain is probably heavier, the deciduous forest gave place to a deciduous bush varying from 3 to 6 feet in height in which oak and hornbeam predominate. In the western

and probably drier area, as well as on the rocks of the eastern part which have thin soils or are unfavourable to holding water, another type of xerophilous evergreen scrub developed—the "pseudomacchia" *—in which juniper and evergreen oak predominate. In those very dry parts of the west in which flocks are numerous, a still poorer form of low scrub—the "phrygana" of which *Poterium spinosum* is typical, alternates with patches of soil bare for three-quarters of the year, but in spring covered with a low perennial vegetation. All these formations have been produced in areas where considerable periods of frost and cold winds are frequent in winter.

The different climatic conditions of the Mediterranean fringe have given rise to a quite different type of scrub to replace the forest. Here the true macchia is luxuriant in growth and rich in species. This bush formation, which has probably arisen from the undergrowth of a forest, resembles only at a distance its imitator described above; it differs entirely from it in a wealth of species and in luxuriance of growth. But the zone in which the true macchia can find the long vegetative period it requires, and sufficient sun to give it the light and warmth it needs, is but a very narrow coastal strip in the south-eastern Khalkidhike. On many of the lower plateaus, particularly where the red clay provides a deep soil, there is a scrub consisting mainly of one species, *Paliurus aculeatus*, which by its prickly defences has defied the flocks and grows to over 10 feet in height. This formation belongs to the "Shiblyak" class of Adamović and according to him replaces the forests, but is not derived directly from their underwood. In all these formations a sub-formation of plane (*Plantanus orientalis*) occurs along streams, sometimes as fine trees, or again as a scrub which in this region replaces the oleander of the true Mediterranean zone.

Agriculture on the plains has gained mainly at the expense of the marsh; the plains as a rule are occupied by permanent agricultural land, and the only natural vegetation are the groves of great elm trees, typical of the Struma plain, which give much-needed shade to the villages in summer.

Agriculture in the hills is intermittent for the most part. A field may be untouched by man for ten years and then again go under the miserable wooden plough of the peasant. There is, therefore, in the plateau areas a constant fight between man and one or other of the scrub formations, and the disused fields generally bear a struggling crop of self-sown annuals—most of which are eaten by the animals, while striking features are the clumps of spiny *paliurus* and in the spring the bright green hellebore, both of which are avoided by browsing beasts. On some of the plateaus, where the headward erosion of the streams has not yet seriously incised the surface, there are flat areas of true meadowland. This is especially typical

* For full discussion of this and other formations in the Balkan Peninsula, see Adamović in 'Die Vegetation der Erde,' vol. II. Leipzic.

of the 500-metre plateaus of Khortach Keui and Larigovo. On the plains there still remain large areas occupied by natural aquatic formations and on a few strips of low coast there are examples of salt marsh.

It will be profitable to examine some of these formations in greater detail.

(1) The Deciduous Forests contain oak, beech, and edible chestnut in varying proportions, and of these the beech is the only tree which forms large woods of a single species. Among the important minor species are a maple (*Acer opulefolium*), the blackthorn (*Prunus spinosa*), the cornel tree (*Cornus mas*), whose yellow blossom provides one of the first signs of spring, a hornbeam (*Carpinus duiensis*), and the wild pear tree (*Pyrus communis*). Of these the last two do not seem to flourish in the high parts and are now more characteristic of the deciduous scrub on the lower plateaus—the hornbeam as a bush and the pear isolated but fully grown. In the higher parts of the Agion Oros peninsula the oak-chestnut forest is mixed with a conifer—*Abies alba*.

The chief areas of this type of forest, as shown on the map, are the higher part of the Krusha Balkan, Beshik Dagh and Khortach Dagh, and in the eastern part of Khalkidhike. In the latter area alone can the forest be seen more or less in its primæval condition, and even here the trees suffer to some extent from the thoughtless attacks of the inhabitants of neighbouring villages. It is said that the usual method of obtaining fire-wood after felling a tree and lopping its branches is to set fire to the trunk so that the heart is burnt out, and then to cut up the shell into pieces of such size that they can be carried off on donkeys. The lack of proper tools and means of transport would account for this wasteful process. I certainly saw some evidence of the artificial burning of the trunks, presumably for this purpose.

(2) The Mediterranean coniferous forest may once have been more extensive. To-day it is confined to the three fingers of Khalkidhike—of which I have only visited Agion Oros—and to two patches near the isthmus of Longos. The sole species appears to be the Aleppo pine (*Pinus halepensis*).

(3) Of the Deciduous Bush I had no opportunity of making a detailed survey, but its dominant species are undoubtedly *Quercus pubescens* and *Carpinus Duiensis*. It is evidently derived from the deciduous forest, and throughout most of its extent its restoration to forest is prevented by the browsing of animals and the constant cutting for charcoal burning. The deciduous bush is best developed on the higher slopes overlooking the Butkova and Struma valleys. In the drier situations, such as the steep south-facing slopes north of Lake Beshik, this bush merges into the more xerophilous scrub types.

(4) The Pseudomacchia is widespread in the western part of the region. It covers all the steeper slopes in the area south-west of Lake Doiran, along the south-west edge of the Krusha-Beshik plateaus; and on

4. STRAKONIKON RIDGE MEETING THE ERISSOS GULF; MACCHIA IN FOREGROUND

5. NORTH-WEST FACE OF MOUNT ATHOS FROM RIDGE OF THE PENINSULA: CHESTNUT AND FIR FOREST

6. CITADEL AND WALLS OF SALONIKA FROM THE SOUTH-EAST

7. MONASTERY OF KHILANDAR, ATHOS

the sides of the deep valleys runs far into these plateaus. It forms the vegetation of the lower slopes of the Khortach Dagh in its western end In the Khalkidhike it is typical of the steeper parts facing the Gulf of Salonika, and it may be traced for many miles with slight variations of species—following a band of limestone through the other plant formations. Its dominant species are the prickly oak (*Quercus coccifera*) and *Juniperus oxycedrus*, and it is always conspicuous as a dark evergreen vegetation. In the more sheltered situations near the sea there is an increase in species characteristic of true *macchia*. Thus on the lower southern slopes of Khortach Dagh and all over Khalkidhike *Erica verticillata* is common, while *Cistus villosus* is found up to about 700 metres. The *pseudomacchia*, and especially the evergreen oak scrub, provides Salonika and many villages with firewood; and strings of donkeys can be seen daily bearing huge loads of the scrub to the bakers' ovens of the town.

(5) The Phrygana is not developed to the extent characteristic of the drier Ægean islands. It is a humble type of vegetation. Indeed, at a short distance the thin soil of the schist slopes backing Salonika appears to have no vegetation cover. But on closer examination the dwarf forms of *Poterium spinosum* and *Astrogallus thracicus* are seen to dominate a formation which is just worthy of mention.

(6) The Paliurus scrub (*P. aculeatus*) has a wide range round the eastern Mediterranean, and the Syrian variety is said to have provided the Crown of Thorns. In Macedonia Paliurus is a handsome plant growing to 14 feet high, and its curved thorns keep beast and man away from it. As it is thus spared interference it easily maintains itself as the dominant and often sole species in a plant formation. It has its greatest development on the lake terraces south of Langadhá and Beshik and on the edge of the Struma plain.

(7) The limits of the true Macchia in this region are the lower coastal slopes of the Khalkidhike (except on its western side) up to an average altitude of about 200 metres, but many of the species characteristic of this formation—presumably the more hardy—overlap into the pseudomacchia and the deciduous scrub, so that the transition is often quite gradual. In the macchia itself the species vary greatly, but a characteristic association is the following: *Arbutus unedo; Arbutus andrachne; Erica verticillata; Erica arborea; Juniperus oxycedrus; Buxus sempivirens; Calycotomy villosa; Cistus villosus; Cistus monspeliensis; Laurus nobilis; Spartium junceum; Olea oleaster*. Where these species are well grown they form an exceedingly beautiful and varied vegetation; the arbutus with its red stems, bright green leaves, drooping white flowers, and globular fruit gradually ripening from a bright orange to a rich carmine; the glowing purple of the heath, the delicate flowers of the cistus and the deep green of the laurel, juniper, and box. In contrast are the glaucous tints of the wild olive of *Spartium* and *Calycotomy*. In places where the macchia had been destroyed by fire it was noticeable that the first plant to reoccupy the

ground was the sticky-leaved cistus (*C. monspeliensis*). In addition to these species there is one which has a very local distribution—*Pistacia lentiscus*.

Of the macchia species the olive is the only one which is cultivated. The trees bear heavy crops in the Agion Oros and at the head of the Gulf of Cassandra, and I believe in the other two peninsulas as well. Olive cultivation reaches its limit in the region of Poliyeros (about 450 metres). The absence of the tree north of the Khalkidhike is symptomatic of the climatic change beyond its main ridge. The usual Mediterranean fruits such as orange, lemon, grape, and pomegranate are all cultivated, but only in small quantities and in the most sheltered gardens near the sea.

Two plants must be noticed, each of which is dominant in special situations. The first is the plane tree (*Platanus orientalis*). As a shrub the plane strives everywhere to fix the moving gravel of the intermittent stream-bed. As a noble tree it lines the banks of the more permanent watercourses of Khalkidhike wherever their valleys widen and alluvium accumulates; while isolated groups of ancient planes are to be found near most of the springs and wells. Where the destruction of forests has been complete, as in the western part of the region, the treasured shade of the plane remains at the water source. The sparing of the plane would seem to have been to the Turk as sacred a duty as the conservation of the water supply and the building of the drinking fountains. The other plant is a verbena—*Vitex agnus castus*—which is the dominant species on the gravel fans at the mouths of the gullies round the plateau edges. This handsome shrub appears to be the first to get a firm hold in a rough alluvium, and so doubtless enables the later vegetation to retain the finer silt and finally to provide a soil fit for agriculture.

Before leaving the vegetation it will be well to draw attention to one or two typical contrasts and transitions. The Resitnik Dere has been described above as a rectilineal gorge separating the high masses of Vavdhos and Kholomon. The summits on either side bear deciduous forest, and on both slopes there is a gradual change downwards through deciduous shrub and pseudomacchia to macchia. The bottom of the *dere* with its southern exposure and protection from the north bears a luxuriant growth of *Pistacia lentiscus*, which apparently here finds its most northerly habitat in eastern Europe.

The journey from Larigovo, at the eastern end of Kholomon, to the east coast affords a very sharp geographical contrast. For about 7 miles the way is practically level on the ancient land surface described above (*c.* 500 metres altitude), which is here occupied by damp meadows and agriculture alternating with strips of oak and beech bush—the relics of the forest which still covers the ridges on either hand. Then suddenly the track emerges to a prospect of intricate deep-cut valleys whose plashing streams are fast cutting back into the ancient surface—which, however,

they have not yet had time to efface from the crests of the spurs that separate them. This young topography imposed by the formation of the sea basin to the east is a great contrast to that left behind, and the contrast is reinforced by the change in the vegetation; for every foot of the quick descent brings the traveller further into the zone of the macchia. Stagiros—the birthplace of Socrates—with its square mediæval keep, and the mining village of Izvoro, are still on the outliers of the old high plateau, but they nestle close under the scarp of the Stratonikon ridge, and are surrounded by high trees including cypresses. These villages command a fine prospect of deep-cut valleys whose sides are thickly clad with the macchia in its greatest luxuriance and variety, and whose alluvial floors are lined with groves of great plane trees (Plate 4).

The flora of the Agion Oros peninsula is fairly well known, and the zonal arrangement of the vegetation on Mount Athos has often been referred to. It appears likely that at one time the lower slopes all round up to about 500 metres were covered by Aleppo pine forest; but this tree, except for isolated individuals, is now restricted to the western barrier ridge, including the Plati promontory and to the main crest as far east as the waist of the peninsula. Elsewhere it is replaced by macchia. From the waist south-eastwards the main crest rises, and it is capped by deciduous forest—mainly chestnut—with a proportion, increasing southwards, of firs (*Abies alba*). A transition typical of the eastern side may be given. From the coast to about 300 metres macchia with individuals of *Pinus halepensis* and *P. pinea*; at this level *Arbutus* disappears, but *Erica* and *Laurus* continue, and a spiny leguminous shrub with delicate leaves comes in (*Cytisus trifloris*). At 360 metres small oak and chestnut trees appear, and increase upwards. At 450 metres we are in fine oak-chestnut forest, with scattered holly and an undergrowth of bracken and *Cytisus*, with patches of fern and moss to bear witness to the moist clouds which frequently cloak this ridge in winter. *Abies alba*, which appears first mixed with chestnut, and which is often associated with an undergrowth of butcher's broom (*Ruscus aculeatus*), increases as the ridge rises to meet the pyramid of Athos; and on the mountain itself this tree grows wherever it can find roothold right up to the zone of dwarf alpine vegetation near the summit. *Abies alba* grows much more luxuriantly on the west than on the east side of the peninsula, and also extends to a much lower altitude there. This fact probably points to moister conditions on the western than on the eastern slope (Plate 5).

The Fauna.

In southern Macedonia one would expect to find most of the mammals of south-east Europe, but the destruction of the forests has so reduced the amount of cover that the bear, the wolf, the deer, and the boar are practically extinct. Deer and boar are still found sparsely in the remaining forests, and wolves appear periodically in the cold winters.

Of the smaller animals, those which from their numbers require most notice are a hare characteristic of the steppe-like western area, and a tortoise which is to be found everywhere in the scrub country. The latter, if not of great geographical importance, may perhaps now be said to have military importance, as he helped to maintain morale, in that his habits provided endless entertainment to battalions in periods of idleness.

The situation and physical features of the region account for some of the most interesting aspects of its bird-life. The cold continental winter drives quantities of water-birds from their summer haunts in eastern Europe. For these Macedonia provides some of the nearest extensive feeding-grounds which do not freeze in winter. In that season then the marshes of the Struma and Vardar literally swarm with geese, ducks, grebes and other water-birds.

Just as Macedonia has been a corridor for human emigration, so it is one of the main thresholds of Europe for in-rushing migrants from Asia and Africa in the spring, and many birds which can find a suitable habitat are content to remain in the area for the summer. Thus the oak woods and the higher bush forest of the plateaus are enlivened in the hot weather by the raucous call and the flashing plumage of the roller, while the traveller on the bare hills is often accompanied by friendly wheatears. A hot summer march through the scrub of the foothills will frequently be rewarded by a glimpse of the hoopoe, and the weary traveller who rests by the side of any running stream on the plains can watch for hours the graceful poise and the beautiful dipping swoop of the dazzling bee-eater, gathering its harvest above the water and eventually delivering the catch to the nestlings in their hole under the stream bank. And the summer picture would be incomplete without the stork, who returns as regularly as by clockwork to his old haunts, the bulky nest on the church tower, broken minaret or ruined chiftlik, or to one of his little colonies in the great elm trees of the Struma plain.

So much for the temporary population. The residents include a great variety of species from our own typical British song birds—which naturally seek the cooler mountains in the summer—to the birds of prey; and special attention must be drawn to this latter class. They are extraordinarily numerous, very varied, and very bold. They range from the vulture to the kestrel, and one and all are apparently ready to hunt systematically over scrub and marsh or, at the call of a fast-borne rumour, to rendezvous at the gates of Salonika and there wrangle over the carcase of some miserable horse which, after being flayed for the sake of its mangy hide, is then "buried," or rather deposited in one of the watercourses of the suburbs. Thus the eagle is a public servant, for at the first rainstorm what is left from the banquet is borne in a roaring torrent of muddy water back to the residential quarter of the town. It is after such rendezvous as these that eagles and buzzards may be studied at close quarters, drawn

up solemnly in line each on a convenient telegraph post. Owing doubtless to the great numbers of birds of prey, the smaller animals in the region are few.

Of the insect life I shall refer only to one genus—the mosquito—which is geographically more important than all the other fauna put together. The region provides an admirable environment for the mosquito, large areas of stagnant or slowly moving water for their breeding-place and favourable temperature conditions. *Anopheles*, *Culex* and *Stegomyia* are all present. Of these Culex is irritating but harmless. Stegomyia is very local in its distribution, and although the species is *fasciata*, the bearer of yellow fever, this disease is happily absent from the region. On the other hand southern Macedonia is one of the most malarious districts in the world. Anopheles breeds all over the region, and it bears the malignant tertian parasite. It brings malaria to nearly every village in the area, on the plateaus as well as on the plains. This mosquito may in fact be said to be responsible for the bad name of the country as much as the proverbial state of political unrest which has existed in the past.

The natives are attacked by malaria in childhood as a matter of course, and the children mostly have enlarged spleens in consequence (70 per cent. in one village examined in the Struma valley). As adults they become more immune, but they remain anæmic for the most part, and the indolence from which they suffer may be partly due to the effects of the disease. The problems facing the commander of the allied armies in Macedonia were to a large extent those of adjustment to geographical conditions, and perhaps the most important of the tasks involved was the fight against malaria; for the effect of the disease upon a large European army hitherto untouched by it was naturally very great. From the preliminary British statistics* given below two things are clear. First, that the disease was exceedingly serious from a military point of view; and secondly, that in spite of the malignant nature of Macedonian malaria the death rate was kept very small, a fact for which the medical service deserves great credit.

MALARIA IN MACEDONIA.

BRITISH ARMY.

Year.	Total admissions to hospital.	Total deaths.	Ratio per 1000.	
			Admissions.	Deaths.
1916	31,059	190	237·2	1·45
1917	71,413	237	350·0	1·16
1918	59,087	271	371·6	1·70

It appears that the hibernating infected mosquitoes wake up in April, as the cases of new infection become more numerous about the end of

* For these as well as for the other facts about malaria I am indebted to the Army Medical Directorate of the War Office.

that month. Then as the new season's insects hatch out and in turn become infected, the number of stricken persons greatly increases and it remains very high from mid-June to mid-September, the latter month showing the maximum number of infections from the malignant tertian parasite. The number of fresh cases then decreases gradually to the end of October. The epidemic season is found to correspond rather closely to a mean temperature of about 69° F.

The People.

The plains of the lower Vardar and Struma have been well described as corridors through which have passed successive waves of immigrants throughout the ages, and our region as much as any part of Macedonia exhibits the characteristic mixture of races. It is very doubtful if any anthropometric survey would be helpful in separating the races, for there has clearly been much blending of blood; but if we take language and religion as the outstanding points of difference we can arrive at a general statement of the racial distribution. The most superficial examination reveals the region as a meeting-place of three leading languages, Turkish, Greek and a Slav dialect, having characteristics of both Serbian and Bulgarian. The well-to-do Turkish owners of the numerous chiftliks of the plains having departed, the remaining Turkish-speaking population occupies, for the most part, the less prosperous villages of the Krusha and Beshik plateaus, and a few villages on the Struma plain, while the district north and west of the isthmus of Cassandra and south of the Galátista plain in Khalkidhike is entirely Turkish.

The Slavs occupy most of the lower Vardar villages and generally the northern part of the plateaus and of the Struma plain, while the Greeks hold Khalkidhike, except the Turkish area above mentioned, and many villages further north. This is a general statement of fact, but there are isolated villages of each race overlapping these boundaries.

The Kutzo-Vlachs, who are the pastoral wanderers of the Balkans, provide a moving element in the population; their proportion can at no time be great, and they have, I believe, no villages in the area, but they must not be forgotten, as their mode of life is distinct from that of the other races. Their language is a Rumanian dialect.

There are a few small colonies of Albanians, but these are quite unimportant.

The Gipsies form an interesting if unimportant element in the population. They are not numerous, but their temporary villages—always unclean—are to be found in the Salonika neighbourhood and near other centres of population. The Gipsies are entirely exotic, very dark skinned; and apparently they never mix with the other races. They too know something of the local languages, but their own tongue seems to be very close to that of their original home. I happened to hear of two cases where British Indian troops speaking Hindustani had no great

difficulty in conversing with the Gipsies. In Salonika the Gipsies perform many of the menial tasks, and their barbaric music with its wailing descending scales lends an attraction to the otherwise repulsive hovels of the suburbs where they live.

The Jews of Salonika form about two-thirds of its normal population of about 150,000. They first became an important element after their expulsion from Spain by Ferdinand and Isabella in the fifteenth century. They have preserved their Spanish tongue almost pure, and while most of the men wear the fez as a relic of the Turkish régime, the older women dress in the fashion of sixteenth-century Venice. A small but important section of the Jews—the Deunmehs—profess Mohammedanism and speak Turkish.

We have seen that man exists here under at least one physical disadvantage (malaria), and there has in the past been at least one moral trouble—continued political instability, while the precarious tenure of land under the Turks and the corrupt methods of their officials were in themselves sufficient to neutralize any keenness on the part of the Macedonian peasant to improve his condition. Thus it is that a large section of the population has so far made no effort at all to overcome the physical defects of its environment; and in some ways they have even increased those defects, by continuing the destruction of the forests, for instance.

It may be said that everywhere the three essential requirements of man—house, clothing, and food—are met. In some parts they are barely met; in others there is a good margin and considerable export. The chief occupations are agriculture, stock raising, fishing, and trading, and of these most of the stock raising is done by the Kutzo-Vlachs and most of the trading by Greeks. Beyond these four, and to a very small extent mining and charcoal burning, there is little specialization, and families are largely self-sufficient, building their own houses, and spinning, weaving and making their own clothes. The production of a surplus in some parts as well as the growing of such crops as tobacco and opium, entirely for export, introduces another minor occupation—that of transportation.

Agriculture.

In our region it may be said that all parts which have any considerable depth of soil have at one time or another been cultivated. The nature of the crop and the success or failure of the cultivation have both been determined by climate and available water supply. At present all the alluvial plains are continuously under cultivation; the red clay of the plateaus and marginal terraces is cultivated intermittently. The whole region can grow crops typical of Central Europe, but the limits of profitable cultivation of certain southern plants, *e.g.* olive and cotton, are within its borders.

The cultivable areas are sharply divided into those which can be irrigated and those which cannot; and while some crops, *e.g.* rice in the lower Struma valley, are grown only where artificial flooding is possible, in all parts the value of the crops is greatly increased by irrigation. The operations on the biggest scale are on the Struma, where water derived from the river and its left-bank tributaries is made to flood large areas; and on the large alluvial fans of the Belashitsa, where owing to the nature of the ground a little water can be made to go a long way. But irrigation on a small scale is practised on every flat area where there are permanent wells, the water being raised by an endless chain of buckets driven by a blindfolded animal.

Agriculture is carried out generally by the most primitive methods. Thus the wooden plough, which barely scatches the surface soil, is almost universal, and much work is done with the mattock. Crops are cut with the sickle and threshed on circular stone floors by means of a small weighted sledge being dragged round and round over the grain by an animal. Winnowing is then carried out by throwing the grain in the breeze with wooden shovels.

The small farmer usually grows a little of a number of crops, the nature of which is determined mainly by the position of his holding. Rotation of crops is not properly understood, and in the hills the conception of fallow-land seems to lead to intermittent cultivation of patches for many miles round the villages. This means first that the peasants make long journeys to their work, and secondly that fields after yielding a crop seem to be left for a number of years untilled, with the result that while there is little of the soil-bearing plateaus which have not at some time or other been ploughed, there are great stretches more or less reverting to scrubland.

In contrast to the primitive agriculture of most of the region, however, are a few districts, notably in the lower Struma plain, where land has been acquired by enterprising Greeks with capital. The tendency of the farmers seems to be to get control of a number of farms each of which is suitable for one crop; and I know of one who owns a rice farm, a cotton farm, a tobacco farm, and a cereal farm. Such men as these are naturally improving the methods of the district by the introduction of agricultural machinery.

The largest areas are under cereals, and of these wheat is the most important, after which come barley and maize, and to a smaller extent oats. The region should with better methods be able to export cereals in quantity. Salonika possesses a grain elevator for the purpose, but I understand it has never been used. The maize crop usually occupies only small fields, but it adds to the picturesqueness of the villages, first by the lines of golden cobs which hang to dry on the cottage walls along with the strings of tobacco leaves and scarlet pepper fruit, and later when the cobs are stripped by the women and girls on the threshing-floors. The maize leaves are used as fodder, and the careful hill farmer builds

his stacks of these in the forks of trees well above the level of browsing animals.

Tobacco is the most important export crop, and it is grown on all scales wherever the soil can hold a moderate amount of moisture. The crop is bought by agents, and after being dried is transported to Salonika on pack-animals for treatment in the warehouses there.

Opium is one of the most valuable crops of the region, and the colour of the poppy-fields on the Struma and Langadhá plains in May and June is very striking. The climate and soil seem to be admirably suited to the crop.

Cotton cultivation shortly before the war had been greatly improved by some of the bigger farmers of the Struma plain, and in spite of the considerable damage that the plants have suffered the crop will no doubt soon become one of the chief sources of revenue to the region.

Mulberry trees are grown all over the lower parts of the area, and sericulture is one of the important minor interests of the farmers. The cocoons are taken to Salonika for export. Viticulture is carried on to a small extent all over, but on a large scale only close to Salonika, on the slopes east of the town.

A minor but interesting local product on the Khortach Dagh is the ice provided for the weary Salonikans in the hot weather. Its existence depends upon the proximity to the town of water-bearing rocks at between 600 and 900 metres altitude. The villagers of Kortach Keui have canalized the north slope of the mountain and dug numerous small reservoirs. These in spring are the breeding-places of innumerable frogs, but in the winter from time to time they freeze. The ice is cut and buried in circular pits on the hillside in the forest, to be produced in summer and sent to Salonika on donkeys' backs.

Fishing is carried on in all the lakes as a regular occupation. The fish are netted, mostly at night from small boats, and the system of beating the water to drive them into the nets is much used. In the marshes round the lakes elaborate fish traps are constructed, composed mostly of closely woven fences of reeds, and these I understand yield a good harvest. The fish are transported to Salonika by pack-animals. Sea fishing is carried on from craft carrying a sail and from six to ten oarsmen, and sailing from a great number of points round the coast, but delivering most of the catch to Salonika. These fishing-boats are a picturesque feature of the Khalkidhike coasts, their archaic build and the method of rowing them—the oarsmen standing upright at the beginning of their stroke and crouching low at the end of it—are features which help the imagination to place them somewhere in the Homeric poems. A peculiar method of fishing is practised at some points round the coast. It consists in placing nets on the bottom of a small creek or stream-

mouth sought by the fish. This net is watched by two men who sit all day on wooden towers above it, and on their observing fish over the net they pull it up out of the water and descend at leisure to secure their catch.

Transport.

In Macedonia it is a profitable occupation to own pack-animals, as by far the greater part of the transport is by this means, for the strong though ill-fed hill ponies, mules, and donkeys are capable of following all the tracks in the region. On the plains the pack-animal is partly replaced by the buffalo, which draws a heavy load slowly but surely in a creaking four-wheeled wain. These animals are rightly valued very highly and, for the country, they are well cared for. Even in the height of summer their native owners contrive to find them some pool in which they can enjoy the mud bath which their health requires. Incidentally the buffalo supplies the best butter in the district.

Prior to the war there was but one main road in the region—from Salonika to Seres—so that the usual means of wheeled transport have never played a great rôle. On the other hand the railway, though principally built for strategic reasons, is undoubtedly a great asset to the region. The Turks, fearing attack from the sea, carried the line round the Krusha plateaus and not by the direct route by Beshik to the Struma mouth; and by so doing they served the whole Struma plain with a railway. The Allies have, however, constructed a line—partly light—through this obvious route, and it will doubtless in time be replaced by a permanent way.

One form of transport remains to be mentioned—the *hamals* of Salonika. These men, Turks, Jews, and Gipsies, can carry enormous loads on their backs, and they are an essential feature even in the hottest weather as stevedores unloading the caiques on the sea front or working in couples—carrying a wardrobe or bed by turns—as furniture removers.

Grouping of the Population.

It might be expected that in a region of such sharp contrast of fertile plain and rocky plateau there would be striking differences in density of population. These differences will in the future be much greater than they are to-day, when the attraction of the plains has overcome the inertia of the plateau population. At present the fact is that the villages of the plains and terraces are much bigger and more prosperous than those of the higher parts, but the grouping of the latter is still remarkably dense. Throughout the region men live in villages and not in isolated farms. This is due mainly to the need for protection, but on the plateaus the population had to concentrate in spots where a perennial water supply coincided with space for cultivation.

The siting of the villages has many points of interest. On the alluvial

plains of the Struma and Vardar, where water can be obtained anywhere by wells, the arrangement of villages is haphazard or due to very minor considerations. On the marginal terraces the sites are generally on patches of the terrace isolated by erosion, and close to the gullies whither the villagers have to go for their water. A good example of this is the line of villages extending southwards from Lake Beshik. All the bigger alluvial fans in the region form the sites of villages, such as Pazarkia on Beshik and Orlyak on the Struma. On the greater alluvial cones south of the Belashitsa the villages are usually placed near the apex, sometimes astride it as in the case of Gorni Poroi. The village then controls the irrigation of the fan, which is completely covered by a system of radiating channels.

One of the most interesting types is the village of the isolated plateaus and basins. The tendency in these is for one large centre to develop, controlling the entire basin. Suho, which nestles under the scarp of the Beshik Dagh, is the local centre for a wide stretch of plateau to the south of it, while Galátista, similarly placed under the barren ridge of Khortach Dagh, is built on and above a patch of the highest sinter terrace, where the springs emerge from the mountain. Galátista has its zone of garden cultivation below it where it can irrigate, its cereal cultivation in the basin beyond this zone and its pastures on the steep slopes round the margin. As it also controls the route to Khalkidhike it has always been a place to hold. It therefore contains an imposing mediæval Turkish keep. Other examples of villages controlling isolated plateaus are Larigovo, Poliyiros, Revenik and Gomati, all in Khalkidhike. The site of Vavdhos is also interesting. It stands on a patch of high plateau to the south of the Galátista basin and some 300 metres above it, facing west right into the eye of Olympus. The property of Vavdhos includes the pastures of the high plateau round the village and on the still higher slopes, and the irrigated vineyards and gardens on the southern rim of the Galátista basin. These two areas are separated by an exceedingly abrupt escarpment, and the climb of 300 metres down and up must make a serious inroad into the day's work of the villagers.

A number of villages are to be found where the sedimentary rocks meet the crystalline rocks of the plateaus. Springs emerge near this line of contact; the clays and marls below provide the agricultural soil, while rough pasture is afforded on the hills behind. A good example of this type is found in the group of villages east of Kilindir basin.

The fishing population of the lakes live on villages close by the lakes, such as Doiran, Aivisil on Langadha lake and Ahinos on the lake of that name. But on the sea-coast villages are always built back from the sea and generally on some height. At the landing-stage or *skala* a group of huts is always to be found for keeping tackle and boats and giving temporary shelter. These huts (*khalivia*) are a feature not only of the sea-shore, but are built wherever the fields or pastures of a village are situated

a long way from the village, and there are examples which answer to the *sennhütte* of the Alpine summer pastures.

The only type of village which can be said to be built on a plan is the one which centres round the old Turkish chiftliks, in which the dwellings of the dependents are arranged in a square about the landowner's much larger house of two or three storeys. The bigger houses, whether built of stone as on the hills, or of wood and sun-dried bricks as on the plains, frequently have the rooms of the upper floors set back to form a verandah.

The streets of the villages are seldom paved and are not over-clean. But in this matter, as in others, the Allied occupation may have a good effect. In one village in which a British Sanitary Section was stationed the villagers are reported to have formed a local imitation of the "—th San. Sect," known in Greek as ὁ Σανσεκ.

Some Historic Sites.

This heart of the ancient Kingdom of Macedonia is, as would be expected, rich in sites of lost habitations of all ages. It will be well to draw attention to three of the most important monuments of classical times—Salonika, Amphipolis and the canal of Xerxes.

Where two of the great routes of the Balkan Peninsula cross, it is obvious that a city must be formed; and where such routes happen to cross at the head of a sheltered arm of the sea the city will be specially important. At the head of the Gulf of Salonika the Great Morava–Vardar "corridor" is crossed by the route followed in Roman times by the Via Egnatia, and at or near this spot there has always been a city. The oval tumulus immediately east of the present town contains in its strata the relics of a number of prehistoric centres superimposed the one on the other. While the position of Thessalonike had been determined in general as described, the actual site of the town seems to have been selected with a view to defence. Where the steep scarp of the Khortach Dagh meets the coast obliquely a fort was built on the tip of the ridge. This fort controlled the landing-place and the traffic along the shore. Moreover, the rocky spur which forms this tip is almost separated from the ridge by two gullies. By commanding the col thus formed, it was easy for the garrison to repel attacks from the ridge. The fort or citadel, then, became the apex of the town which grew up on the triangular slope between the two gullies and the sea; the two land sides of the triangle from an early date have been flanked by city walls, while the landing-place itself was made secure by the construction of a very massive round-tower fort at the termination of the east wall. This triangle is the heart of the Salonika of to-day. The steep upper town with its winding lanes and stairways, overhanging houses, and secluded shady courts is typically Turkish, and still contains the Turkish population. The more gentle lower slopes with straight but narrow streets contained, until the fire, the bulk of the closely

packed Jewry; while the narrow flat of the shore formed the site of the cosmopolitan town with its hotels—now burnt down—and its main road flanked by the many-coloured craft moored alongside to discharge their loads of island produce on the tramway line (Plate 6).

The Via Egnatia climbed over the Khortach Dagh east of Thessalonike, and after passing south of the lakes and through the gorge, crossed the Struma close to its mouth. On the plateau (or threshold) trenched by the Struma (Strymon) above this point was founded the Athenian colony of Amphipolis, controlling the access to the fertile plain to the north of it. This city, founded in B.C. 437, was so named because Strymon flowed on both sides of it, and a wall was built across the loop. Many passages of Thucydides are devoted to its history, and from the writings of Herodotus it is clear that this meeting of the "nine ways" (*ἐννέα ὁδοί*) was an important centre for two centuries at least before the foundation of Amphipolis.

The building of a ship canal by Xerxes is one of the most remarkable pieces of "war work" which has ever been undertaken. The Persian general, having lost his fleet in a storm on the rocky coast of Athos, determined not to risk a second disaster, but organized a Macedonian labour corps, and in three years had cut his canal from sea to sea and brought his newly built fleet one stage nearer to Greece. Without some investigation on the ground it is impossible to say just what this involved. At the present time the isthmus of Xerxes is about 2300 metres wide, and the site of the canal is, I think, at its highest point, about 40 metres above the sea. The cutting would therefore seem to have been over 40 metres deep. Throughout most of its course digging to this depth in the soft marls would not be difficult, but at the west end is a barrier of very hard gneiss. It is therefore tempting to assume that the isthmus has risen somewhat since the time of Xerxes, although I saw no evidence of this on either coast. The site of the canal is very easy to trace throughout. Except for two small lakes it is filled up with soil, but is marked out by a strip of flat green turf about 50 metres wide.

The Khalkidhike occupies a curious position in Europe. Although close to one of the trade routes it remains as a little eddy in the stream of civilization—a relic of the middle ages or before. It owes this chiefly to its physical features. For centuries the Via Egnatia saw the march of armies and of traders along its northern edge, but the flanking ridges made this part of the Roman road a mere corridor. Khalkidhike has a very long coast-line, but the three rocky fingers were ever landmarks to be given a wide berth by the fragile Ægean craft. Of harbours for these craft there is no lack, but the broken plateau edges on all but the west coast leave no easy approach to the sea, and on the west coast there are

no harbours. Thus it is that but for the spasmodic attempts to exploit the mineral wealth of Khalkidhike the peninsula has been left to itself. And so to-day the traveller meets no wheeled vehicle, even in the central basin, for there are no roads. He sees the most primitive agriculture, and as he wanders from village to village the impression grows on him that he is back in the time of legendary folk tales:—the goatherd is there clad entirely in skins; he spends his whole life in the open and develops the springing gait of his charges—surely the Pan of the ancients; the hermit charcoal burner is there; and the mendicant friar of old is represented by the tattered monk from the outlying *metokhi*. The wits of the people seem to him remarkably slow. He meets on a hill path a shepherd who can never have seen his like before—in my case an armed party of British soldiers with a string of mules of relatively gigantic stature. A greeting passes on both sides, but the shepherd lets the strangers get several hundred yards on their way before his brain really works, and then comes the hail from across the valley, "Who are you? Whence came you? Whither going?" and so on.

The traveller crosses the remains of the Xerxes canal—or "the Xerxes," to give it its local name, and after four hours' march over steep tracks paved with cobbles turns in the gloaming into a little valley lined with cypresses, and suddenly comes upon what is surely the veritable castle of the fairy tales—turrets and domes, courts and balconies, all closely set amongst cypress and olive groves and backed by dark pine woods. But no fairy prince is there, for it is the Serbian monastery of Khilandar (Plate 7). And yet the mediæval impression is not weakened in the least, as the nature and meaning of monkish hospitality dawns on the stranger. The little cavalcade clatters into the great triangular court flanked on two sides by the monastery and on the third by the ancient church and tower of St. Sava. The mules are unloaded and led away by the monks. The British drivers are left wondering. The baggage is hoisted on pulleys to the top balcony. Great wood fires are soon roaring in the stoves of the guest chambers, and ere long the guests themselves are enjoying a hearty meal in company with the head of the community. At sundry intervals through the night the great bell in the tower rings out, and the peculiar insistent clatter of a wooden instrument—the prototype of the corncrake of the towing-path—resounds through court and corridor, calling the monk to the church.

Thus was it possible by a short march to be transported, if not quite beyond the thunder of war, at least beyond its turmoil, and still more wonderful—to be carried back in effect through five centuries of time. It is this detachment from the wrangling of south-eastern Europe and from the modern "rush"—if such it can be called in these parts—which provides the *raison d'être* of the Holy Mountain community. A little reflection shows this community to be a complete geographical freak or anomaly—some 7000 men living without women and without female

animals, on a rocky promontory with few level spaces for building sites. The community is fed and maintained almost entirely from outside, largely by farms (*metokhis*) in the Ægean islands and coastlands belonging to the monasteries and worked by the monks, while the Russian communities before the war were maintained mainly by food and money sent from Russia. This population, then, is maintained by the resources of other parts. Its physical and mental energy is used up in the conduct of long and arduous religious duties. In the past the community, in return for its keep, gave to the Mediterranean world education and handicrafts. To-day it would appear on the whole that the inheritance of the Holy Mountain from the middle ages is one-sided and incomplete.

Conclusion.

We have seen then this region of Macedonia as a district of sharply contrasted relief and soil, with a climate mainly Mediterranean in character but with spasms of overflow of the mid-Europe winter conditions. We have seen that its population has three main racial elements, of whom two—the Greek and the Turk—are by long habit more accustomed and suited to the type of life and work born of Mediterranean conditions, and the third—the Slav element—belong to a race which normally inhabits regions with a more continental type of climate. We have further seen that all three, as well as the minorities the Vlachs and Gipsies, with but little exception have hitherto made no effort to do more than gain a bare livelihood by the most primitive methods of agriculture, of stock rearing and of fishing. But we must remember that the politically uncertain state which has reigned in the land has given little encouragement to better things. Our brief examination of the geographical circumstances of the country entitles us, however, to look into the future as we have looked into the past and to see how the inhabitants properly encouraged may utilize the conditions of their environment in the years to come.

Hitherto the three human physical needs of food, clothing, and house room for the population in general have been barely met, and certain trade and exchange has gone on to a small extent for many centuries. But with stable government the Macedonians can look for something better, and if in the future each family no longer builds its own home and makes its own clothes we shall certainly lose much of the picturesqueness of the region, but on the other hand the peasant with instruction and capital will become a more productive cultivator, the fisherman with new craft and harbours will gain a more certain living, and the shepherd and goatherd, if sensibly treated, will no longer be in constant opposition to the farmer, and will find a ready market where his wool and his milk will be sold to the best advantage. Moreover, by closer contact with the World's wool market he may be induced to improve the quality of his goods.

It is possible to forecast in a general way how these changes will affect the region. In the first place the chief source of wealth is its agriculture, and the plains and small basins provide sufficient land, if properly farmed, to support the pre-war population and many besides. On the other hand it is unlikely that people of many of the upper villages will ever make a success of their thin soil even if they learn better methods. It would therefore seem advisable to attract these farmers to the plains. Now if we remember that the plains and basins are the chief centres of population and that this must become more and more true, we realize that to make a complete success of the economic and social life of the region, five things are necessary. First, the drainage of the swamps with its consequent reduction of malaria; secondly, the organization of irrigation so that all may benefit by it; thirdly, a just and equitable system of land tenure; fourthly, the introduction of a co-operative system in farming such as has long been in operation in Denmark; and lastly, the provision of agricultural education accompanied by the supply of machinery and fertilizers. I venture to say that, given a stable government, the capital invested in meeting these five needs will not have to wait long for its interest.

So much for the bulk of the plains and the basins. There remains the hills and also certain tracts of low country such as the Ravna plateau between Salonika and Doiran, where irrigation cannot be practised. These are the areas which ought primarily to be devoted to forestry and to the raising of sheep and goats. But it is unnecessary to state that these two cannot go on in the same area. The parts most suitable to forests must be enclosed, and sooner or later—that is, so soon as afforestation is economically possible—this region could provide supplies of good oak, beech and chestnut timber sufficient for its own needs and for other parts of the Ægean lands where forestry is out of the question. It must be remembered that all over the hills there are small plateau surfaces now providing bad farming land, but which would probably prove to be admirably adapted for planting, especially if precautions be taken to reduce evaporation from the soil as much as possible in the dry months.

The remainder of the upland scrub country must be given over to the flocks. But it will not be sufficient to turn over this land alone to the shepherds and goatherds. The long-established migratory habit of life of these pastoral Kutzo-Vlachs must be respected by any government which undertakes the regeneration of Macedonia. The Vlach shepherd in fact, who must be regarded as a useful element in the national economy, requires upland pastures in summer and lowland pastures in winter, and definite areas of the plains, especially in the campagna of Salonika, would have to be set aside for this purpose. In the unlikely event of the agricultural populations proving to be too dense for those areas where irrigation is practicable, there is always the possibility that the agricultural

methods usually referred to as "dry farming" would enable much more ground to be brought under the plough with success.

With such agricultural expansion exchange must increase enormously, and exchange brings us inevitably to means of communication and transport. As pointed out above, these included in the past the human porter or *hamal* of the town, the donkey, mule or pony of the miserable hill tracks, and the creaking buffalo wain of the plains. There were but two roads in the whole region, and the railways round its northern margins. But since 1916 it has been brought home to the meanest peasant that roads and light railways can be made in remarkably short time, and that he has much of the materials for making them near at hand; and he cannot have failed to realize that they can be of great use to him when made. Of course not all the roads and light railways laid by the Allied armies in Macedonia for war are in places which would be chosen for the purposes of peace. For instance the lower Struma plain has not been covered with metalled roads which the new agriculture will demand of it, for that plain was threaded throughout its length by the front trenches of the opposing armies. But on the other hand the construction of a Decauville line through the Langadhá plain to the Gulf of Rendina and Struma mouth clearly foreshadows the provision of a permanent railway through this agricultural valley which since prehistoric times has been an important route.

The regeneration of Salonika as a regional capital and a leading European port might easily form the subject of a separate treatise, for its great future must be apparent to all, even though its exact political position as an outlet to the wares of the states to the north of it is not yet clear. The town suffers from a bottle neck. Its only possible lines of expansion are along the coast eastwards on the residential side and westwards from the district now given up to warehouses. The steep slope of the central town between those two comes so close to the quay that the east-west traffic is seriously hampered; moreover, an additional embarrassment is provided by the *caiques* or small sailing craft which discharge their cargoes of fruit, wine and charcoal and other island produce all along the main tram line of the city. One of the benefits of the great fire of August 1917 has been to free for reorganization a large tract just inland from this route, and if properly handled the difficulty of this constriction will be overcome. But the gaily painted *caiques* must go elsewhere with their cargoes, and with them will vanish the picturesque figure of the *hamal* who unloads them. The port of Salonika will have soon to be greatly enlarged, additional warehouses will have to be built, and the municipality will have to realize that geography has provided a renewed greatness for their city and that they must play their part in the reconstruction of their civic life.

There are two features of the physical circumstances of Salonika which are of great importance and which will demand attention in the near

future. They are the insufficient water supply and the relation of the Vardar mouth to the port. In Roman times the town drew its water by a number of aqueducts from springs in the Khortach Dagh behind the town. Some of these still operate, and the Allies have constructed a modern pipe line from the same source. But the bulk of the town supply is now drawn from a ground water-table in the buried gravels of the Vardar delta well below sea-level. The pressure obtained by the existing pumping plant is quite insufficient, and it remains to be seen whether this source can be rendered adequate. If not some means may have to be found of utilizing the water of lakes Langadhá and Beshik.

The two primary considerations in the enlargement of the harbour of Salonika must be protection from the sea and provision to counteract silting. The physical features of the bay are such that, while it is protected from most winds, there is a long fetch with a south-west gale, and considerable breakwaters must be built to make an enlarged port safe from this direction.

The conditions of silting depend upon the shape of Salonika gulf and bay, upon the almost complete absence of tides, and upon the fact that the Vardar river discharges a heavy volume of solid matter annually. For long the Vardar stretched the principal finger of its delta towards Karaburun, and threatened to shut off Salonika altogether, but the mouth which that finger carried is now virtually deserted, and the main discharge is opposite little Karaburun and nearer Salonika. Although there is now little danger of the bay being eventually shut off, the fact that wave action and surface drift produced by south-west winds drive much of the Vardar silt round the shore to the harbour will have to be taken into account in the development of the port.

Before the paper the Chairman (Mr. DOUGLAS W. FRESHFIELD) said: Captain Ogilvie, who is going to address us to-night on Macedonia, is an old friend of the Society, and one of the most distinguished of the young representatives of geography whom Oxford has turned out. Before the war he was working with the late Prof. Herbertson for two or three years at the Oxford School of Geography. When the war broke out he was an officer of the Territorial Artillery, and went very soon to the Levant. Last year he contributed, as you will remember, an interesting paper on the island of Imbros, which he was unable to read here owing to his absence at the seat of war, where he has been employed on the survey at Salonika. He has hurried here to-night from Paris, where he has been giving the benefit of his considerable knowledge to the Peace Congress; or shall we call it Conversazione?

Captain Ogilvie is to lecture to-night on Macedonia. I am reminded that one of Mr. Gladstone's claims was, "Macedonia for the Macedonians," and the first difficulty that was felt in dealing with it was that nobody could tell who the Macedonians were! I trust that Captain Ogilvie will be able to throw a little light on the subject to-night. But he asks me to say that he does not pretend to speak for the whole of Macedonia. His experiences have been limited to one portion of it, and he would prefer that his lecture should be termed "A Contribution to the Geography of Macedonia." Having regard to

the length of some recent lectures, I feel it is desirable to-night that your Chairman should not occupy more time than needful, and I will therefore ask Captain Ogilvie to commence his lecture at once.

Captain Ogilvie then read the paper printed above, and a discussion followed.

The CHAIRMAN: I will ask Prof. Ernest Gardner, of the University of London, who has just returned from Salonika, where he has been acting as Naval Intelligence Officer, to address the meeting.

Prof. ERNEST GARDNER: I make no profession to be a geologist, and am quite incapable of criticizing the extremely interesting and valuable paper which we have just heard. I will only make one or two supplementary remarks on the points raised from the point of view of what has been, to some extent, personal experience. First of all, as to the winds. I was extremely interested in the diagrams which we saw on the screen. They explained, to some extent, what I have never understood before, that the historical and geographical importance of these winds is very great indeed. It has certainly shown itself very great in connection with one event in history in Salonika, and that is, the great fire. That great fire would not have destroyed the whole town as it did unless the Vardar wind had happened to be blowing at the moment. In connection with this there is a saying, which may or may not be true, and on which I should like Captain Ogilvie's opinion, that the Vardar wind, when it blows, always blows for three days and then stops. So far as my observation goes, I believe this to be fairly in accordance with facts, and it certainly was so on the occasion of the great fire. But it was the occurrence of the fire accidentally in the extreme north-west corner of the town, coupled with the fact that the Vardar wind was blowing from that direction, which caused the immense destruction that it did. There is another interesting wind in Salonika, a feature which it probably shares with other towns, and that is the regular afternoon wind in summer, which is of great importance for the health, and, one might almost say, for the possibility of living in the town. On the hot summer days there is a wind called the *imbat*, or *batis*, which rises every afternoon about 2 o'clock and blows strongly up the gulf until sunset; it even raises a considerable sea, and very often renders boating difficult. This wind makes all the difference to the climate of Salonika in summer, because as soon as it gets up you no longer have the close, oppressive feeling you have in the mornings. The question of nationality is one I do not propose to touch on now. It is much too late, and the question is far too serious to be dealt with in a short time. I would only say I quite agree with Captain Ogilvie in his belief that the Turks have probably not very much real Turkish blood. A great many of them, however, who are, I think, not exactly Macedonians but immigrants from Anatolia or Asia Minor, constitute to some extent a distinct element, though I do not think, strictly speaking, they are really Turkish. But the thing that I think impresses one most throughout the country is the great contrast between present conditions and previous conditions. One is constantly coming across remains of earlier times. You saw the great mound above Salonika, to which Captain Ogilvie referred, the site of an earlier town. Such mounds occur frequently all over Macedonia, and are almost always placed on the foothills. Some of them are in the plain, but this is exceptional. The villages on the foothills are probably placed there, as so often in Greece, in order to escape from the malaria which one finds in the plains. It is also partly on account of the malaria that the villagers have to spend so many hours passing to and fro between the towns and their work in the fields.

Another thing which strikes one is not only the amount of remains of prehistoric times, when I think there must have been a very high civilization in Macedonia, but also of later Roman and Byzantine times. All over the plains one is constantly, when digging, finding remains of water-channels and aqueducts, and of irrigation pipes. The system of irrigation of late Roman and early Byzantine times must have been very extensive, and with its help the country must have been most productive. It seems to me that this offers a very great encouragement for the future, because what happened before may happen again, and so there is every hope that Macedonia may, with a stable Government, again become a rich and prosperous country, very different from the comparatively barren region which it now is. There are great possibilities in the forests. Some of the most delightful pieces of forest I know are in various parts of Macedonia, especially in the Khalkidhike.

As regards the quays of Salonika, I am afraid it is not a satisfactory arrangement commercially to have so many miscellaneous ships along the quay discharging their cargo on to the mainland. On the other hand, I think that the quay, with its selection of boats from all the Greek islands, is a complete study of eastern Mediterranean shipping. It may have to go, but I must say I should regret it extremely. I do not know anything more beautiful in Salonika than that quay with its various types of boats always ranged along it. There are types from all the islands, and one can read the names of the islands on the boats, and study all the different types of sailing-boats, and most beautiful they are. The danger to the harbour at the mouth of the Vardar must have struck everybody who has been there. It is a problem that has been faced elsewhere, and will have to be faced here. It is exactly the problem that faced Smyrna where the river Hermus has been diverted. Something of the sort will have to be done with the Vardar, and as far as one can judge, it does not look as if such a proceeding will be at all a difficult engineering undertaking. If the Vardar is diverted from its present course and given an outlet into the sea further to the west, where it has an old mouth, the danger from the silting up of the mouth of Salonika harbour will be overcome. There are one or two other remarks suggested to me by the paper, but it is too late to keep you further. I only wish to express what I am sure we all must feel, how very interesting it is to have heard so much information with regard to Salonika, put together in such a scientific and systematic manner. Those of us who have been to Salonika and spent some time there will, I am sure, always feel that they have been enabled by this paper to put together their information and to understand and realize it in a way they have never done before.

The CHAIRMAN: I will ask Lady Grogan, who has been working for the Serbian Relief Fund, to address the meeting.

Lady GROGAN: My own acquaintance with Macedonia dates from 1903, so perhaps Captain Ogilvie will allow me to say something about it. I have been there a great many times since, and travelled and lived in the country. I have been much interested in the lecture, which has covered a great deal of ground, and leaves one with the hope that now something will be written in English about the botany, geology, archæology, and history of Macedonia. In my day, one had to go to the Germans for nearly everything. There were a few old books of travel which were delightful reading—for instance, the works of Urquhart, Tozer, and Miss Irby; but for anything technical I think one would have to go to German books. My own interest has been mainly a human interest, a political interest. It must be so in the Balkans. I should

go a little further, perhaps, than Captain Ogilvie. He used the word "Slav." We need to use the word "Bulgarian." I think there are six peoples, more or less, who inhabit Macedonia, and it is certain they never could be divided into watertight compartments. Very often you find one half of a village Greek, the other Bulgarian; or it may be Turkish and Greek. But it is my conviction that no settlement in the Balkans can be a just or final one that does not take into consideration the fact that the bulk of the inhabitants of Macedonia are Bulgarians. It is an unfortunate fact. You may call them Slavs, but they themselves think they are Bulgarians, and in the Balkans a man is what he thinks he is and what he has suffered for being. The Bulgarians of Macedonia have suffered as Bulgarians for many generations. It was as Bulgarians that they rose against the Turks in 1903, and it was because they were Bulgarians that they were heavily punished by the Turks. And then there is one more point. It is not a wise thing to put one Balkan people under the domination of another. I do not think there is any exception to that rule. I see that the Conference is sending a Commission to Syria to inquire into the wishes of the Syrian peoples, and one wishes they could send a similar Commission to the Balkans—only I think one would like to choose the Commissioners or have a voice in the choice. Further, I should like to say that I think it was good for us to see those pictures of Macedonia. A great many people here said, "Why does not the Salonika Army advance? How is it the Serbians do not move? They are accustomed to the mountains." We have seen pictures of one section of the country, but what we have not seen is the wonderful mountains near Monastir, where the Serbians did make their move, and the marvel is that they were able to make it at all. Another thing is, that a picture cannot show the marvellous colouring of Macedonia. Those mountains are bare, very largely owing to political conditions, because the Turks cut down the forest wherever they go in order to avoid leaving any covering for an enemy near their habitations; so that one always finds forests cut round the towns. What Captain Ogilvie said makes us hope that he will write more, and let us have some further information in a permanent form.

The CHAIRMAN: If there is no other Fellow who has a knowledge of Macedonia who would like to address the meeting, I must wind up the discussion, and I am sure in doing so you will all wish me to render our sincere thanks to Captain Ogilvie for the comprehensive, instructive, and interesting paper he has read to us, a paper in which he has shown how geographical facts may be used in forming a basis for dealing with human interests. There was only one, to me, disappointment in his paper, and that is that we did not hear more about the landscape. Lord Bryce, who has been, I think, everywhere, is wont to expatiate on the mountain scenery he saw when he went up into the region beyond Salonika. To-night we did not get up into that region. We were dealing with only a portion of Macedonia—the lower ranges and foothills. The two last views which Captain Ogilvie showed of Mount Olympus, seen across the gulf, were to me tantalizing. I had hopes that he would tell us that a British party had been sent up to survey those heights. The Austrian maps are deplorably bad. The tops of Mount Olympus until a few years ago were quite unknown to Europeans. The brigands kept all travellers away from them. I recollect on one occasion the late Lord Tennyson saying to me, "Why don't you go up to Mount Olympus? You cannot tell; Zeus may be there still." I hunted through the literature of the district, but could find no description of the mountain-top or of its ascent. Some Swiss travellers succeeded just before the war in reaching and photographing the highest peaks, and I am in hopes

some members of our force out there may before long be able to read us a paper which can be illustrated with these photographs, which are shown in the case in the hall at Lowther Lodge. However, I am wandering into a relatively small matter that interests me personally. I return to the lecture we have heard to-night. I sincerely hope that all Captain Ogilvie has told us has also been inwardly digested by the appropriate committee at the Congress in Paris. I now ask you to accord your thanks to Captain Ogilvie for his paper.

THE ISLANDS AND CORAL REEFS OF FIJI

W. M. Davis

Emeritus Professor of Harvard University; Gold Medallist R.G.S. 1919

Part I. The Volcanic Islands

PREVIOUS to my departure in January 1914, on a nine months' voyage across the Pacific, subventioned for the study of coral reefs by the Shaler Memorial Fund of Harvard University, I made a preparatory "Home Study" of this old problem which was published during my absence in the *Bulletin* of the American Geographical Society,* the predecessor of the present *Geographical Review*. Since my return in November 1914 the preparation of a report on the thirty-five islands visited has taken much time; but the completion of the report has been interrupted by indirect war-work—and even if completed I should not have wished to see a large monograph on so remote a subject published under my name while the war lasted. However, in order to set forth the chief results reached, not only by observation on various Pacific islands but by much reading and reflection afterwards at home, I have written a number of short articles on special aspects of the coral-reef problem, a list of which is given at the end of this paper. In one of these, on Tahiti, the attempt was made to give a fairly full account of a single island, in so far as its physiographic features are related to the reefs that surround it. The present article is the first that describes a group of islands from the same point of view.

Fiji is chosen for this study, partly because the eighteen islands visited in that archipelago gave me a much better idea of the archipelago as a whole than I gained of any other; partly because Fiji contains so interesting a variety of islands and reefs; but more particularly because the conclusions reached regarding the origin of the Fiji reefs differ so fundamentally from those announced by a number of earlier observers. As far as my analysis of the problem goes, the reason for the disagreement of conclusions comes

* The omission on p. 724 of this article of the name of E. C. Andrews, of Sydney, New South Wales, as one of the recent Australian investigators of coral reefs was a regrettable oversight.

from an essential difference in methods of investigation. The present article therefore gives emphasis to certain lines of evidence, chiefly physiographic and geologic, which have been almost wholly neglected by earlier students of Fiji reefs, and which when duly considered lead to the selection of Darwin's theory of reef upgrowth during intermittent subsidence as a more competent explanation of the origin of the Fiji reefs than any other theory that has been proposed.

The traveller who makes the voyage to New Zealand and Australia on a trans-Pacific liner gains a brief impression of Fiji as he passes through the archipelago and touches at Suva, the capital, on the southern coast of the largest island, Viti Levu. The impression is much strengthened if he stops off at Fiji for a few weeks and continues his journey on a later vessel, thus gaining time for an inexpensive trip among the islands on a trading steamer. As the *Amra*, on which I thus passed ten days, was commanded by a most courteous young captain, a former student of the University of Sydney, who made me at home on the bridge, the less agreeable quarters below were avoided and excellent opportunity for observation was afforded. But the deepest impression of Fiji in my experience came from leisurely excursions from island to island on small sloop-rigged cutters, fitted with auxiliary engines and manned with native crews.

Much may be said against knocking about in the open sea among the islands on small boats, for the trade winds beat up formidable waves, and the discomforts that the cutters provide fall little short of being unendurable; moreover, a staunch cutter with its native crew, chartered for one's own purposes, costs the discouraging price of about £4 a day. Nevertheless the acquaintance that such a boat gives with the sea, the reefs, the lagoons, and the islands is intimate and profitable. My Shaler-Memorial journey in 1914 gave me six experiences of this kind, varying from a morning's sail to a nine days' cruise, but as these excursions alternated with intervals of rest during which, as a guest at Government House in Suva, I enjoyed the well-ordered amenities of civilization, the cutter trips are now remembered chiefly as entertaining and profitable occasions. On the nine days' cruise I was accompanied by Mr. W. J. B. Stinson, of Suva, by whom a number of the photographs illustrating this article were taken. The chief results of my observations are here set forth with relation to the origin of coral reefs.

Most of the high islands in Fiji are, as has long been known, of volcanic origin. True, the volcanic rocks of the north-westernmost large island, Viti Levu, are reported by geologists to rest at certain points in the interior on a non-volcanic basement of continental rocks, but the geographical features of the basement rocks have been little described. The visible mountainous topography of all the islands is developed in large measure on erupted lavas, yet the islands rarely exhibit the conical form associated with young volcanoes and lava-fields, because volcanic eruptions

on most of the islands ceased so long ago that the islands are now elaborately dissected.

A few exceptions to this rule came under my observation. One was on Kandavu, the south-westernmost large island of the group, 30 miles in length; on the western end of this island the broadly truncated, young volcanic cone of Mbeke Levu, or Big Yam—also known on the charts as "Mount Washington"—rises to a height of nearly 3000 feet. I had a good view of its simple, unsymmetrical profile from a few miles further east near the northern coast of the island, as in Fig. 1. The first ascent to the crater rim of this mountain is claimed by Seemann in 1860; he described it as "evidently an extinct volcano . . . nearly 4000 feet high" ('Viti': Cambridge, 1862, p. 215). Its height was later determined to be 2750 feet. The steep slopes are little furrowed by ravines, but they are somewhat broken, as if by sea-cliffs, on the north-eastern side. One shore of the mountain is pictured by Seemann as strongly cliffed, as if in the

Fig. 1.—The young volcanic cone of Mbeke Levu at western end of Kandavu, Fiji, looking west

absence of a protecting coral reef it had been attacked by the waves; the title of this picture states that it shows the volcano as "seen from the south," but it surely should be "from the west" or "north," as its base reaches the sea only on those sides.

It is interesting to note in connection with the coral-reef problem that Mbeke Levu stands on an island which bears manifest marks of subsidence, as will be further detailed below; and this serves to counteract the belief that active volcanoes occur only in regions of upheaval. It is true enough that eruptions and upheavals may occur together; witness the recently elevated strand-lines on the New Hebrides island of Ambrym, which is crowned with an active volcano: but there are many examples of the reverse relation. Yet Guppy thought that the occurrence of barrier reefs and atolls in association with active volcanoes placed "the supporters of the theory of subsidence in a dilemma" (*Scot. Geog. Mag.*, 4, p. 136; 1888). Somewhat later Hickson argued that the atoll of Passiac, north of Celebes, could not have been formed by upgrowth during the subsidence of its foundation because the active volcano of Ruang lies only 3 or 4 miles away ('A Naturalist in N. Celebes,' p. 5; 1889); but in reaching this conclusion he disregarded the embayed shorelines of other neighbouring islands which testify strongly for subsidence. The article on the Pacific Ocean in the ninth edition of the 'Encyclopædia Britannica' definitely states that active volcanoes occur in "regions where geology teaches us that the land is either stationary or is undergoing slow upheaval." Murray

1. Mbuala valley and bay, Ono, looking south-east. Shoal fringing reefs at sides : delta at head of bay

Phot. by Stinson

2. Corniced shore-line 4 feet above sea-level, on eastern side of Ovalau north of Levuka, looking south across bay between the two farther headlands of Plate 6 (Pt. II.)

3. Cliff walls of Namosi valley eroded in volcanic rocks of Viti Levu

Phot. by Stinson

4. Village on bay-head delta-flat, eastern side of Totoya caldera-lagoon, looking south. Entrance to central lagoon by breach in caldera-rim in distance

Phot. by Stinson

went farther still, for he not only accepted the belief that active volcanoes and upheavals are causally connected, but extended it in his arguments against Darwin's theory of subsidence to apply to extinct volcanoes (*Proc. R.S. Edin.*, 10, 516).

On the other hand, various geological investigations discredit the necessary association of volcanic eruptions and crustal upheavals, for this belief is hardly more than a survival of the obsolete theory of craters of elevation. A striking passage in Sir Archibald Geikie's 'Ancient Volcanoes of Great Britain' may be cited in support of the more modern view: "A study of the records of volcanic activity in Britain proves beyond dispute that the volcanoes of past time have been active in areas of the earth's surface that were sinking and not rising" (vol. 2, 470). Hence the occurrence of an active volcano—much less the occurrence of extinct volcanoes—cannot be safely adduced as evidence that neighbouring coral reefs have not grown up during a subsidence of their foundations.

The island of Taviuni—persistently misprinted "Tavinni" in the entertaining narrative of 'The Earl and the Doctor'—23 miles in length in north-eastern Fiji, makes another exception to the rule that the volcanic mountains of this group are so old as to have lost their initial conical forms. Here four large cones, given on the chart as 3590, 4040, 3920 and 3210 feet in height, and a number of small cones, rise along the south-western half of the island axis. Seemann ascended one of these high volcanoes also, and found its top "to all appearance a large extinct crater filled with water" ('Viti,' pp. 28, 29). Horne states that "there are no large streams on the island. In many instances the water flows underground through caverns, which are numerous, and boils up on the beach or a short distance out in the sea" ('A Year in Fiji,' p. 160; 1881). The caverns here mentioned are probably to be interpreted as lava-flow galleries, such as are known on Hawaii and elsewhere. Surely the lack of large streams cannot be due to deficient water supply, for the volcanic range stands across the trade winds and is frequently covered with rain-clouds.

The north-western or leeward slopes of the Taviuni volcanoes, of which I had a good sight from the *Amra*, are steep, concave in profile heavily forested, and but little dissected by ravines; they descend to a relatively simple shoreline, which here and there advances in short and low salients of resistant lava, while the intermediate re-entrants are cut back in low bluffs. Harbours are lacking here, but as this coast of the island is protected from the trade-wind swell, landings are easily made from open anchorages. The windward side of the island, also reefless and harbourless in its south-western half, is avoided by mariners; it is probably more strongly cliffed than the leeward side.

Coral reefs are as yet imperfectly developed in discontinuous fringes on

the young shores of south-western Taviuni, except that at the extremity of the island the V-like loop of Vuna reef extends 2 miles into the sea, and encloses a small lagoon. Forbes gives a good description of this gigantic breakwater, and also of a destructive hurricane on Taviuni in 1871 ('Two Years in Fiji,' pp. 47, 204; 1875). The Vuna reef is apparently the surviving part of a more extensive structure, the rest of which was overwhelmed by recent lava-floods from young cones. If so, it testifies to the absence of upheaval in association with the eruption of lava that concealed its greater part, for it is still at sea-level.

Gardiner explains the general absence of reefs around Taviuni by the action of the tidal current in Somo-somo Strait, which is only 4 miles wide between the middle of Taviuni and the Waikawa salient of the large island of Vanua Levu on the north-west (*Proc. Camb. Phil. Soc.*, 9, 446; 1898). But inasmuch as reefs are wanting also on the other side of Taviuni, where the island faces a wide stretch of open sea, and as they are well developed along the embayed shore of the Waikawa salient on the other side of Somo-somo Strait, and as corals thrive in surf of Vuna reef, where the motion of the water is much swifter than that of a 5-knot tidal current, this explanation is not satisfactory. Agassiz notes that "Taviuni is, with the exception of the shore fringing the northern half of the island and of the point of reefs off Vuna Point, destitute of reefs" (*Bull. Mus. Comp. Zool.*, 33, 42). Neither of these zoological explorers considered the recency of the Taviuni lava-flows in their bearing on the absence of reefs.

The north-eastern part of Taviuni appears to have escaped being deluged with recent lavas. Andrews notes that "the later basalt does not appear to have influenced the topographical features of this division of the island" (*Bull. Mus. Comp. Zool.*, 38, 24; 1900). The hills there are of more irregular form, as if they were the result of erosion on ancient volcanoes; and this part of the island is bordered by a fringing reef and surrounded by a submarine platform, 2 or 3 miles in breadth and 40 or 50 fathoms in depth, with a rapid descent to deep water at its margin. Submarine platforms of similar form, but of somewhat less depth, constitute lagoon bottoms enclosed by barrier reefs around several neighbouring islands, which, unlike Taviuni, rise in deeply eroded mountainous hills from strongly embayed shorelines. The Taviuni platform is therefore peculiar not only in being of unusual depth, but also in not being rimmed with a barrier reef.

The volcanoes of Taviuni rise not far away from other islands which, like Kandavu where Mbeke Levu stands, have deeply eroded forms and strongly embayed shorelines, and which thus testify to subsidence, as will be further explained below. On Taviuni itself, however, some benches which may indicate elevation, were noted at a moderate height along the mid-northern coast. I was unable to determine their date with respect to that of the recent eruptions, but think they are older, for they are cut

across by valleys of more mature expression than the ravines which here and there furrow the volcanic slopes.

In any case subsidence appears to have prevailed in the neighbouring region, and the exceptional depth of the rimless Taviuni platform suggests that subsidence, probably more rapid than usual, has taken place there also. This supposition finds some support in Budd reef, an almost-atoll 12 miles in diameter—that is, a barrier reef encircling a lagoon containing only small volcanic islands—10 miles north-east of Taviuni; for there also the lagoon has depths of more than 40 fathoms, and the encircling reef is unusually narrow, as if subsidence had been both recent and rapid. Curiously enough a small crater-rim island, Thombia, breached on one side and evidently of recent eruption, rises to a height of 580 feet in this lagoon; hence here, as in Kandavu and probably in Taviuni, eruption and subsidence appear to be associated.

None of the other volcanic islands in Fiji preserve their initial eruptional forms so well as those above mentioned, although in some of them the more or less radial valleys by which they are dissected are the work of streams that appear to be consequent upon the original radial slopes of the volcanic cones. The small island of Ono, about 3 miles in diameter, north of the eastern end of Kandavu (not to be mistaken for Ono-i-Lau, in the far south-eastern extension of the group), is a good example of this kind. I sailed all round it on a day of perfect weather, and ascended a spur on one side of its largest north-western embayment; it was thus possible to see not only the pronouncedly radial arrangement of its embayed valleys, one of which is shown in Plate 1, but also the outward slant of its lava-beds on some of the valley-sides; and from these facts both its original conical form and the profound modification of that form by erosional processes may be fairly inferred.

The radiating valleys of Ono are wider than those of the much larger island of Tahiti in the Society group, and the spurs between the valleys are much more irregularly dissected by lateral ravines than are the Tahitian spurs: hence Ono may be regarded as a maturely dissected volcanic cone, while Tahiti is only submaturely dissected. Ono has, moreover, evidently lost height while suffering dissection, for if the slanting lava-beds of the outer spurs were prolonged inward and upward toward the island centre they would rise high above any hills that now stand there. Some of the spurs, capped by resistant lava-beds, after rising gradually for half a mile or more inland from the shore, fall off in steep escarpments toward the island centre, as if their capping lavas were undermined by weaker tuffs; or perhaps these infacing scarps are the dissected remnants of an original caldera wall. But even if Ono originally had a crater or caldera-like cavity in its summit, the floor of the cavity as well as its walls are now deeply dissected below their primitive surface, as is shown by the hills in the island centre, Plate 1; the island may well

have lost a quarter or a third of its original volume, and fully a half of its original height.

Ovalau (Plate 2), near by Viti Levu on the east, and Mbengha, near by on the south—one somewhat larger, the other a little smaller than Ono—are like it maturely dissected; both of them exhibit slanting beds of lava or of volcanic agglomerates on the sides of their radiating valleys, from which a reconstruction of their initial form might be attempted. Ovalau appears to have been a caldera ring, like Totoya, to be described below, and Mbengha may perhaps consist of a less dissected cone on the north-west partly covering the ruins of a more dissected cone on the south-east; my time on the islands was too short to test these suppositions.

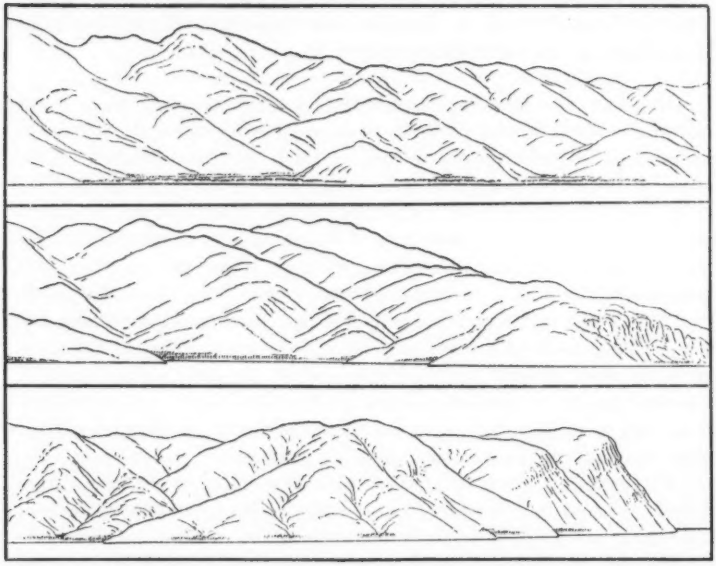


Fig. 2.—Kandavu (1) looking south into Tavuki bay; (2) looking west across Tavuki bay; (3) looking west at Mt. Hosken (1195) and John Wesley bluffs

Kandavu, the largest south-western island, appears to be only an irregularly linear cluster of larger Onos, with the addition of the young Mbuke Levu at its western end, the undissected cone of which now overtops the dissected remains of all its older companions. Some of the elements which compose Kandavu still resemble young volcanic masses in being of conical outline, though deeply furrowed; others are of irregular form, as in Fig. 2, and so jumbled together that the identification of the original cones could not be safely attempted without much more study than I had time to make. The same is true of most of the islands of the group; with few exceptions they are elaborately carved, and with every additional

ravine they gain variety of form and beauty of outline, in contrast to the uncarved simplicity of young cones.

Thompson, who made a survey of Kandavu, compared its mountains with those of "modified lunar landscapes"; but this gives no sufficient suggestion of the erosion that they have suffered; his mention of "deep fissures, forming rifts" (*Scot. Geog. Mag.*, **5**, 638) implies a greater measure of fracturing in the production of existing forms than appears warranted. The manner in which branching spurs of the Kandavu mountains interlock with the ramifications of their well-incised valley systems suffices to show that neither eruption nor dislocation, but erosion is the dominant cause of the visible forms. The further facts that the spurs are as a rule well rounded and that the valleys are well opened show that the erosion of most of the mountains on this beautiful island has reached a well-advanced or mature stage of its progress.

The large islands of Viti Levu or Great Fiji and Vanua Levu or Great Land may be considered as broad clusters of Kandavus. Their mountains are of greatly diversified form, the work of advanced erosion on the original cones of eruption. Some of the crests are sharply serrate, others are broad and massive. Some of the valleys in Viti Levu have precipitous side walls, as in Plate 3; others are more maturely open. The mountains of Vanua Levu are built of volcanic products which appear, from the many detailed descriptions by Guppy ('Observations of a Naturalist in the Pacific,' London, 1903), to be the product of long-continued submarine as well as supermarine eruptions, yielding many extensive lava-flows, tuff deposits and agglomerates, from numerous centres at diverse dates; they are now dissected in different degrees. None of the mountains that I saw on these large islands resembled young volcanoes. The absence of lakes among the mountains is highly significant of the dominance of erosion over eruption in producing the existent topographic forms.

In spite of the well-developed valley systems that characterize the dissected volcanic islands of Fiji, various observers have described these islands as if they were chiefly formed by eruption. Thus the island of Matuku, 4 by 5 miles in diameter, in the south-central part of the archipelago, is of bold and serrate form, with an embayment on its western side which Wilkes described as "one of the best harbours of the group" ('Narrative U.S. Exploring Expedition,' 3, 145; 1856). The summits of the island (Fig. 3) reach altitudes of 1000 or 1200 feet, and are ranged on an arc of a quarter or third of a circle, open to the west; some of the peaks resemble denuded volcanic necks. The slopes are deeply furrowed by ravines and valleys. Here as on most other islands of the group, erosion has greatly modified the forms due to erruption.

Yet the *Challenger* description of this island, probably written by Mosely as the same sentences occur in his 'Notes of a Naturalist' (p. 254),

is as follows: From the summit of the highest peak, "the island was seen to consist of a single crater, the edge of which had been denuded and cut into a series of fantastic peaks, with intervening steep-sided gullies. The ancient crater itself now forms the harbour, the inlet to which is through an opening in the girdling reef at a spot where the border [of the crater?] has been broken down" ('*Challenger* Narrative,' 1, 487; 1885). A similar opinion was later expressed in the report of the German exploring vessel, *Gazelle*: "Wahrscheinlich aber stellt die ganze Insel den grosseren Theil eines gewaltigen Kraterrandes dar, dessen andere Theil versenkt und mit Korallen bewachsen ist" ('Forschungsreise,' 3, 271; 1889). In view of the size of the supposed original cavity, it should be called a caldera rather than a crater.

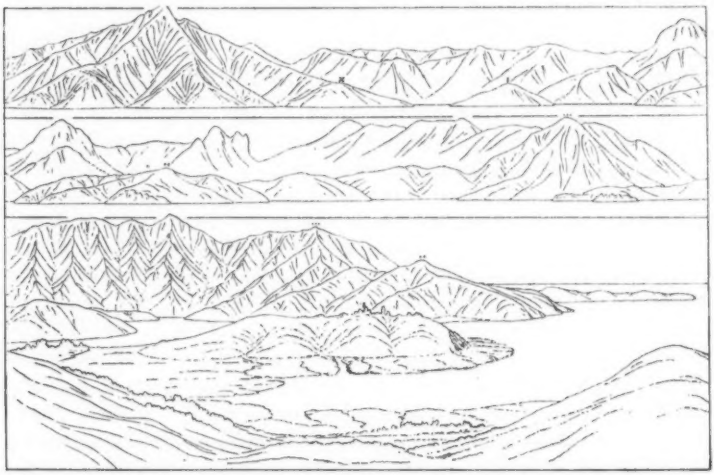


Fig. 3.—Matuku (1) and (2) Panorama from N.E. to S.E. (3) looking south from x of (1) across western bay partly filled with mangrove swamps

If the lava-beds of the Matuku range all dipped outward from the watery centre of the range-arc it might be necessary to adopt the above suggestion, at least as to the initial outlining of the western bay as a caldera cavity; but much modification by erosion, as well as deep down-faulting of the western half of the original ring mountain would still be essential, in order to produce the existing form of the island. However, no statement is made in the above-cited reports as to the general centrifugal dips of the lava-beds, nor could I see any persistent indications of such a structure on the western and northern sides of the island. If the range arc were completed through the missing two-thirds or three-quarters of its circuit, its western part would stand where the sea bottom is now about 700 fathoms in depth; hence the down-faulting would be about 3000 feet. There is on the one hand nothing impossible in this, and on the

other hand there is nothing in favour of it but the curvature of the mountain range and the unreasoned assumption that all cavities in volcanic mountains are craters or calderas.

Even if future observation of the structure of the Matuku range shows that it consists of centrifugally inclined lava-beds, as if it were part of a large caldera rim, it would still be necessary to assume not only great down-faulting of the western half, but also strong dissection of the caldera floor as well as of the surviving arc of its rim, in order to produce the present form of the island; and a considerable submergence would then be needed to produce the embayments of the present shoreline, as will be further explained below.

My own conclusion in this matter is that the reasons for regarding the western bay of Matuku as a "crater" are, like the reasons for supposing that active volcanoes are limited to areas of upheaval, derived from an obsolescent geological philosophy, in which much was made of the violent processes of eruption, and little was made of the slow processes of erosion in shaping volcanic mountains; and that in the absence of structural evidence in favour of a caldera origin, the Matuku bay is most probably a large valley or a group of valleys of erosion, not closely related to any crater or caldera, and partly submerged. Several smaller bays in other parts of the Matuku shoreline and many bays in other volcanic islands are demonstrably of this origin.

The explanation of the bay of Matuku as a crater is not the only example of an old-fashioned interpretation. A navigator in the first half of the last century suggested that an ordinary bay in the northern part of Nairai, in the centre of the Fiji group, presented "the appearance of having been an old crater"; a zoological explorer at the end of the century said, in describing a long embayment on the eastern side of Moala, not far north of Matuku, that "the ridges surrounding the deep bay have the appearance of being the rim of an extinct crater . . . broken to the eastward, . . . the bay forming the bottom of the extinct crater." Similarly, certain observers in New Zealand have explained Lyttleton harbour, one of the longest of the many long arms of the sea that enter the deeply dissected and moderately submerged volcanic mass of Banks peninsula, as a crater. I saw all these embayments in 1914, and believe that they are all, like scores of others, nothing more than partly submerged valleys of erosion. Had the observers above referred to considered this possibility and given reasons for rejecting it in favour of the other, the case would be different; but they did not do so.

Craters and calderas are certainly striking features of young, undissected volcanoes, and in such volcanoes there is no objection whatever to recognizing the eruptive or explosive origin of their summit cavities. The smaller cavities, properly called craters, are characteristically the product of constructive eruption; the larger cavities, better called calderas,

are as characteristically the product of destructive explosion or of engulfment. Vesuvius offers illustrations of both forms; its upper cone has a true summit crater, the rim of which is built up by out-thrown ashes; and this upper cone, a feature of modern origin, rises excentrically from a pre-existent caldera, of which it buries the western rim, while the eastern rim, submaturely dissected, is known as Monte Somma. Like the rest of an extinct volcanic mass, the walls and eventually the floors of craters and calderas must ordinarily be subject to erosion; a breach in the wall expedites the dissection of the crater floor, which when once attacked may be completely transformed. It by no means follows, however, that every deep valley heading in a greatly eroded volcanic mountain is in any close way related to an initial cavity in its summit.

On the other hand, a well-defined cavity, enclosed by a ring wall of outward dipping lavas, tuffs or agglomerates, should be interpreted as having originated as a crater or caldera, even though the wall may be more or less dissected by ravines on its inner and outer slopes. No other interpretation than a dissected caldera rim can, indeed, be given to the beautiful ring island of Totoya (Plate 4), 20 miles north-east of Matuku; its circular crest, of moderately serrate form, measures about $3\frac{1}{2}$ miles in diameter and includes nearly a score of summits between 700 and 1200 feet in height; the outer diameter of the island at sea-level is 5 miles; the diameter of the central lagoon is between 2 and 3 miles. The rim has a breach $1\frac{1}{2}$ miles wide on the south, by which access is given to the lagoon; a $\frac{1}{2}$-mile breach on the west is closed with sand. Both the inner and the outer slopes of the rim are moderately steep; they are well furrowed by ravines, so that the rim should be described as "maturely eroded." It thus contrasts strongly with the rim that encloses the caldera known as Crater Lake in southern Oregon, for although the outer slope is there also well furrowed, showing that the primitive mountain was dissected before the caldera was formed, the inner slope is precipitous and little dissected.

The little ring-island of Thombia in Budd reef, above noted, also appears to be a well-accredited crater-volcano, and apparently younger than Totoya; it is a mile in diameter, 580 feet in height, and breached on the east. On the other hand, Ovalau, above mentioned as lying next east of Viti Levu, is very probably a maturely dissected caldera-rim island; for otherwise the deep cavity within the mountainous rim could hardly be explained. It appears to be somewhat older than Totoya, for the exterior slopes of its 3-mile ring of summits—the highest over 2000 feet in altitude—are deeply scored by many valleys; its central hollow is drained by two deep breaches on the west. Ono-i-Lau, the south-easternmost member of the Fiji group, appears on the charts to be a crater-rim island, and it has thus been described by Foye (*Proc. Amer. Acad.*, 54, 61; 1918). It is very probable that other ring mountains will be found in Fiji.

To a navigator, it is immaterial whether a bay occupies a submerged crater of eruption or a submerged valley of erosion. To an old-fashioned geographer of the empirical school the origin of a bay is likewise a matter of indifference: he is satisfied to know its form. To a modern geographer of the rational or evolutionary school, an understanding of the origin of a bay is of interest, because experience shows that he can obtain a better knowledge of the bay through the aid given to observation by understanding than he can obtain through observation alone. To a student of coral reefs, the origin of the embayments in reef-encircled islands is of prime importance, because it is largely through the evidence regarding changes of level obtained from the history of the embayed islands that the movements which have controlled the formation of their encircling reefs are discovered. It is therefore chiefly as an introduction to a discussion of the Fiji coral reefs that the volcanic islands of Fiji have been described in the foregoing pages. In order to appreciate the bearing of this introductory discussion upon the origin of coral reefs, the relation between coral reefs and volcanic islands must be stated.

(*To be continued.*)

THE CARTE DU MONDE AU MILLIONIÈME

THE second international conference of the 1/M map was held in Paris in December 1913, at the invitation of the French Government, and a preliminary account of the conference was given in the *Journal* for February 1914, but no official report of its proceedings and conclusions had been published at the outbreak of the war which has so profoundly affected the future of all such international agreements. The *Comptes rendus des Séances de la Deuxième Conférence Internationale*, with the imprint *Paris: Service Géographique de l'Armée*, 1914, have been received only within the last few weeks, and we have to consider them in the light of a totally new situation.

For a student of Conference tactics the meeting at Paris had many valuable lessons. The more or less open warfare between the military and the academic delegates of Germany robbed them of any considerable influence on the proceedings. The significance of German anxiety that the text of certain resolutions left unaltered from the London conference of 1909 should be authoritative only until the date of the next conference after Paris was revealed by the invitation to meet again in Berlin. On the other hand, the excellent preliminary understanding between the heads of the *Service géographique* and the Ordnance Survey gave to the Franco-British front a solidity that now seems almost prophetic; so that when it was proposed that a central bureau for the map should be established in England, "quelques membres ayant demandé la disjonction

du vote sur le principe de la création d'un Bureau central et sur le choix du pays où ce Bureau devra être établi, cette disjonction est repoussée."

The conference began very wisely by agreeing that the fundamental resolutions of the London conference should stand unalterable—such as the size and boundaries of the sheets, the system of projection, and the uniform expression of heights in metres—and that attention should be concentrated on such questions as selection of contours and layer colours, conventional signs, and spelling of names, wherein the resolutions of the first conference might be improved in detail without sacrifice of general principles. Space will not allow a detailed discussion of the decisions on these matters, which may be studied on the sheet of conventional signs embodying them, published with the proceedings of the conference. Without departing anywhere very widely from the pattern to which the few sheets published before the War were made, the new characteristic sheet shows many small and a few great improvements on the original type, notably in the contours and the colour scale. The contours are in fine black lines instead of in brown, and the colour scale runs up into a warm chestnut-brown instead of into the ugly magenta which disfigured the first; it omits, however, and we think unfortunately, the pleasant soft yellow that made a gentle transition from the green to the brown of the original scale.

Accompanying the characteristic sheet are the "gamme officiel," or scale of layer colours, and a very useful key to the printing of these colours, the latter published by the Bureau Central at Southampton, but printed we think at the War Office. The latter is an admirable lesson in colour-printing, which only the highest technical skill can follow; and indeed we may note that the "gamme officiel" falls short of perfection, the sequence of tints being temporarily inverted between 2500 and 3000 metres, while the colour scale attached to the characteristic sheet is less satisfactory still, making no sufficient distinction between the two shades of green, using too coarse a screen for the pale blue tints of the sea, and showing the sea-level contour or coast-line in blue instead of black. To secure anything like a perfect match between the sheets produced by different establishments will tax all the critical resources of the Central Bureau.

The function of this bureau, established at the Ordnance Survey Office at Southampton, is to publish an annual report, and to organize the exchange of information between all parties interested. For example, the establishment undertaking a new sheet will give notice to the Bureau, and duplication of effort will be avoided. At a later stage the compilation will be submitted to the Central Bureau for criticism, to secure uniformity, and finally, specimens of completed sheets will be sent for distribution to the contributing Governments. The director of the Central Bureau proposes, with the approval of the Council of the R.G.S., that the Map Room of the Society shall serve as the auxiliary Bureau in London, where all reports and specimens shall be available.

When this proposal was accepted by the Conference the President remarked that the establishment of such a permanent Bureau was in effect the constitution of an international cartographic association, on whose importance it was superfluous to insist. The long duration of war impeded the full realization of this plan, and no annual report has yet appeared; but we understand that a number of Governments have paid their contributions—the small sum of 150 francs annually—and with the conclusion of peace its future must be considered. Since it was not the subject of a diplomatic convention, it escaped—at least formally—the general massacre of most Conventions in the Treaty of Versailles; but since, on the other hand, the subscriptions are to be paid by Governments through diplomatic channels, it cannot escape profound modification as the result of the war.

A month before the conclusion of the armistice, delegates of the national Academies of the Allied nations met in London and made plans for the organization of an International Research Council, limited in the first place to the Allies, but allowing for the eventual adhesion of neutrals, though not of enemy States. Under the auspices of this Council a meeting was held in Brussels last July, to which delegates were appointed for the formation of two Unions, one of Astronomy, the other of Geodesy and Geophysics, with elaborate constitutions and endless committees—no less than thirty-two as a start for the various branches of astronomy. It would, we think, be premature to assume that the control of the Carte du Monde au Millionième should be entrusted to a section of an analogous Geographical Union, such as was talked about by unauthorized delegates at the Brussels meeting. We had a strong suspicion that there was no real need for a third Map conference, at Berlin, and that if the proposal was accepted, it was only because it was difficult to refuse the Germans their turn, after London and Paris. Now that the Germans are eliminated, and the sheets that they ought to have done are perhaps sufficiently replaced for the time being by the unconventional issue which the Society helped to provide, one feels that the best thing for the International map would be a good long period of quiet recuperation, without any more conference. Only one or two sheets of the canonical series have been produced in the last five years by any other nation than ours; while the sheets of the Near East—Asia Minor, Syria, and Arabia—reproduced by the War Office, though nearly canonical, are not precisely those sheets that we had any particular right to do, from an international point of view. The political situation of the 1/M map is, in fact, as irregular as might be expected in the present state of the world; and we think that by far the best thing for it will be to leave it alone to straighten itself out gradually with the help of the Central Bureau. For this reason we should deprecate any attempt of the International Research Council to take it under the wing of a Geographical Union.

THE KONGO-SAN

Miss Hilda C. Bowser

THE Kongo-san, or "Luminous Religion" Mountain, or "Diamond"* Mountain, is an extraordinary cluster of peaks in east-central Korea, part of a great mountain range forming the backbone of the Korean peninsula. It stands in the north-eastern part of Kogen province, and is divided into Uchi or Inner Kongo, Soto or Outer Kongo and Shin or New Kongo. The mountain area is about 50 miles in circumference, and covers more than 25 square miles. The peaks, reputed to number twelve thousand, are entirely granite, with dense forests on their sides and at their base. All are extremely rugged and grotesque in form, and it is impossible to scale many of them, as they rise nearly vertical, while their slippery sides furnish no foothold. All these peaks project from a series of rocky ridges, standing one behind the other like huge screens, and form numerous ravines and canyons through which icy water runs tumultuously. These streams greatly contribute to the incomparable beauty of the mountain, as they form hundreds of roaring waterfalls, with deep and placid pools.

Tradition says that it was to the Diamond Mountain that Buddhism first came direct from India in A.D. 5, and that fifty-three Buddhas landed with a shipload of scriptures at a point a little south of Chozenport on the east coast. They then established Buddhism at Yutenji (Yu-chom-sa in Korean), and later, monasteries were founded at Choanji, Hakka-an, Seiyoji, and other places up the wonderful gorge of Choanji. The records discovered last autumn in some of these monasteries show that the mountain was a place to which royal personages, who were devout Buddhists, repaired in the Middle Ages, and both Korean and Chinese pilgrims and artists have left their marks upon the rocks in beautifully incised Chinese characters and carved Buddhas, many of which date back to the thirteenth century.

The fall of the Koryu dynasty in A.D. 1391 was supposed to be due to the corrupt influence of Buddhism, and since then, and until a few years ago, the Korean Government has looked down upon it as an outcast religion; but in the secluded Diamond Mountain abbots and priests retained their culture, and temples prospered in Eastern Korea. But no Buddhist priest was admitted within the walls of Seoul, the capital, for five hundred years. Now, however, since the annexation of Korea by the Japanese, a change in the administration of Buddhism and Buddhist monasteries has occurred in the Peninsula, and in 1912 regulations controlling monasteries were instituted. Priests are now admitted to the priesthood by examination; their appointments are made for three years

* The Diamond Sutra is one of the most popular of Buddhist books. The Korean name of the mountain is Keum-gang-san.

SEA KONGO, KOJO

URA BAMBUTSUSO

KWANYIU PEAK FROM SHINKEI-JI MONASTERY

OKU BAMBUTSUSO

THE GREAT BUDDHA, KONGO SAN

only, and if at the end of that time their conduct and qualifications are not satisfactory their appointment is not renewed.

In May 1916 I made my first expedition to the Diamond Mountain, with the Rev. C. T. Collyer and Mrs. Collyer of Gensan, who speak Korean fluently, and Mr. Kim Pyeng-jen, a Korean gentleman.

We left Fukkei on the railway halfway between Seoul and Gensan, for the Buddhist temple of Choanji, three days' journey from Fukkei. The way led through beautiful valleys and over hills covered with brilliant spring foliage and lovely flowers, such as Solomon's seals, columbine, pink, white, and yellow azalea, violets and anemones, and literally millions of lilies of the valley.

At Changdo, which we reached by 7.30 p.m. after accomplishing 100 li,* the only rooms available were the only dirty rooms encountered during the eleven days' expedition. To Korean inn proprietors the Japanese Government will not now issue licences unless the rooms are cleaned out periodically and the walls colour-washed, and they are inspected by the police or a gendarme at stated intervals.

In the late afternoon of the second day our chair coolies showed signs of fatigue after accomplishing 70 li. From a great height we had our first view of the Diamond Mountain 30 miles away. Glorious panoramic views of chain upon chain called "The Barrier" divided us from it. The inhabitants of a hamlet through which we passed warned our men of the difficulty of taking horses across the Tan-bal-yang Pass. The descent proved to be rough and difficult, and we could not reach Choanji that night, so settled to stay at Puk-chang. Soon after leaving next day we passed several cromlechs and entered the Two Thousand Li Pass. By the late afternoon we had reached the fine old monastery of Choanji, or the Temple of Rest.

Through the kindness of Mr. Akira Watanabe of the Home Department of Affairs in Seoul, our introductions to the Abbots proved most useful. At Choanji we were received with much ceremony, and for half an hour the Abbot and his assistant sat on a verandah conversing. Rooms were allotted for our use and here we stayed for three days, and thence visited other temples pitched in places very difficult of access up the wonderful gorge. Surely the beauty of that gorge is not much exceeded anywhere on earth.

From the Pavilion at Seiyoji are seen colossal cliffs upbearing mountains, boulders of granite 40 and 50 feet high, pines on their crests and lilies in their crevices, shelving rock surfaces on which huge Chinese characters, the laborious work of pilgrims, afford the only foothold, and smooth rock made passable for determined climbers by holes drilled by the monks, fitted with pegs, rails, and chains. All of these can be seen from the Pavilion. Pagodas, sotobas,† and stone lanterns ornament the

* 10 li equals 3 miles. Korean coolies can easily cover 100 li in a day.

† Burial-places of the Abbots.

grounds of many of the temples, while frescoes, ponderous bells, paintings, and Buddhist books are worth examining within. The books are of great value, many being of exquisite calligraphy in the Chinese character,* others having been printed from wooden blocks a thousand years old. All the books are placed in brass-bound Korean chests, many of which decorate the altar of the principal worship hall.

A dreadful climb brought us one day to the Angel's Pool. Nearly all the names of peaks, waterfalls, pools, and other places of beauty are derived from Buddhist terms, and so, further up in the chasm, we came to other pools named Tortoise, Dragon, Pearl, Ship, etc., with fine waterfalls descending to each of these pools. Other places of interest that must be mentioned are the Bambutsuso (Ten Thousand things), the Nine Dragons Chasm, the Onseiri Pass, 10 miles long and extremely rough, and the Umi or Sea Kongo with its magnificent basaltic columns.

There are four Bambutsusos: (1) Bambutsuso = Ten Thousand things; (2) Shin Bambutsuso = New Ten Thousand things; (3) Ura Bambutsuso = Backbone Thousand things; (4) Oku Bambutsuso = Facing the Sea Thousand things.

In 1917 I had the opportunity of making an expedition over the Ura Bambutsuso, a trip that no foreigner had ever taken, as the overgrown footpath was only known to a few Korean coolies. The way leads up the Onseiri Pass for 10 miles. Arriving at some tungsten mines at Shimpori (2349 feet), we left the road and for a short distance took a small and overgrown footpath to the north. Pressing on through jungle to a height of about 3500 feet the "backbone" was reached in about two hours. Soon we were on the saddle and looked into the very heart of the canyons as they radiated from the backbone, with range upon range of mountains lying below and a distant view of the Sea of Japan. There were enormous boulders grouped in the most fantastic attitudes, some so lightly poised that it seemed as though a high wind would easily blow them over. Things of every description were represented. Gigantic thumbs, distorted fingers, stately pillars and columns, grotesque animals, Korean mourners' hats, and "ten thousand things" reared their attractive heads on every side. Some of the mountains are densely forested, and bears and tigers have been seen. We found beautiful pink Turk's cap lilies, scabious, and a wealth of ferns. After several hours of rough and steep descent to the west by Oku Bambutsuso, we reached the little whaling village of Chozenport, and a tramp of 5 miles on level ground brought us at 11.30 p.m. to our headquarters at Onseiri. In a twelve-hours' climb and descent no dwellings of any kind were passed, and we did not meet a single human being until we reached some tungsten mines two hours before arriving at Chozenport. The superb scenery of this unknown part of Korea quite repays one for the fatigue that must be endured in reaching it.

All the names of places mentioned in this paper are Japanese.

* All educated Koreans read Chinese.

SHACKLETON'S LAST EXPEDITION—A REVIEW

Hugh Robert Mill, D.Sc.

South. The Story of Shackleton's Last Expedition, 1914–1917.— Sir Ernest Shackleton, C.V.O. London: William Heinemann. 1919. Pp. xxii., 376. *Illustrations.* *Price* 25*s.*

THE story of the *Endurance* as told in the first part of this volume is a memorable achievement. The polar regions have seen many triumphs and tragedies of exploration in the last four hundred years, and when our mind turns to the journeys of Nansen and Peary over the Arctic floes, the drift of the *Hansa* and the *Deutschland* in the northern and southern polar pack, and the long boat voyages of Willem Barents's comrades and of Leigh Smith after unexpected winterings in inhospitable islands, we cannot say that the past has left much chance for breaking the record of human endurance, courage, and resourcefulness in the polar regions. Nevertheless we are inclined to place this story of the *Endurance* at the very head of all records of polar adventure on account of the variety of the risks encountered, the accumulated difficulties overcome, and the almost incredible deliverance of the whole ship's company. The Britons of the twentieth century in this adventure stand in the front rank of adventurers of all time. The story is well told and finely illustrated. If the narrator keeps himself as leader in the forefront throughout, the reader can but acknowledge the fitness of the position. Shackleton did things that other explorers might have done, but which no other explorers, as a matter of fact, have done. Seeing what his deeds were, we are struck with the combination of fearlessness and modesty with which he tells what he did.

Little is added to the essential facts of the narrative which have been summarized in these pages (*Geographical Journal*, 48 (1916), p. 68) from the first telegraphic report. The *Endurance* with Sir Ernest Shackleton's party left England on 8 August 1914, after the services of the ship and all on board had been offered to the Admiralty for war purposes and declined. They left South Georgia, of the stay at which further particulars would have been very interesting, on 5 December 1914, and navigated the eastern side of the Weddell Sea to 76° 34′ S., where the *Endurance* was beset by the pack on 18 January 1915, after coasting Coats Land and coming within sight of Luitpold Land. The drift of the pack carried the ship along the coast south-westwards until on 22 February 1915 she was in 77° S. about 60 miles north of Vahsel Bay, where it had been intended to land and whence Sir Ernest Shackleton was to have started for his march across the continent to Ross Sea, passing the South Pole on the way. It became clear then that no start could be made that season, and soon afterwards the drift of the ice began to carry the ship to the north. On 27 October 1915 the *Endurance* was crushed in the ice in 69° S., and she sank a few weeks later, leaving the party camped on the moving floe, where they remained during the whole of the following summer. The account of the destruction of the ship is very moving, and the photographs enable the reader to realize in a very vivid way the grim ending of the hopes of the expedition. Until 6 April 1916 the twenty-eight men lived on the floe in hourly danger from the cracks that often opened close to their tents, and on that day the three boats were launched in 62° S., and on 13 April 1916 they all succeeded in landing on a narrow beach on Elephant Island. If the party had remained here waiting for a relief expedition, the chance of any surviving to return home would have been

small indeed. Had they attempted to reach a frequented coast in the three battered boats, most of the men would undoubtedly have perished. Their safety was due to Shackleton's instant decision to make for South Georgia in the largest boat, and to Frank Wild's unique experience of the art of living on next to nothing in the Antarctic, and his power to keep up the heart of the companions left under his charge. Fortunately the conditions of the twenty-two men left on the island were not so terrible as at first reported. They were not compelled to take refuge from the waves in a cave dug out of the glacial ice ; but were able to build a hut, roofed with the two upturned boats, on a strip of beach beyond high-water mark. The least diminutive boat, the *James Caird*, was partly decked by means of sledge-runners, box-lids and the canvas of a wrecked tent, and in this little whaler of 22 feet in length (about two-thirds the length of the ordinary ship's lifeboat familiar to travellers by sea as an encumbrance to the upper deck) Shackleton with five companions set out on 24 April 1916, in the hope of reaching South Georgia, 750 miles distant across the wildest stretch of ocean in the world. South Georgia is a small target to hit at such a range, and on the few occasions when astronomical observations were possible the use of a sextant on such an unstable platform as the heaving boat must have been nearly impossible ; but the nearly impossible was an almost daily occurrence in this whole adventure, and Captain Worsley succeeded in taking and working out some very serviceable positions. On 10 May 1916 the boat entered Haakon Bay, and after a few days' rest and feeding up on albatross chickens, Shackleton and two companions faced another labour as nearly impossible as the last, and in a continuous march found their way across the snow-mountains of South Georgia, which had never been crossed before, and arrived at the whaling-station of Stromness on the morning of 21 May 1916, if we have divined the date aright from the text. Without rest Shackleton set himself to the task of relieving the men on Elephant Island, first from South Georgia, then from the Falkland Islands with the help of an Uruguayan vessel, and twice from Punta Arenas in Chilean vessels. None of the four small craft was fit to enter the ice, and three times he had to turn from the close investment of the floes ; but the fourth attempt, almost impossible as it was to reach the island in the depth of winter, succeeded, and the *Yelcho* brought the whole party safely to Chile.

So far the book carries the reader along in a torrent of emotion and ever-changing incident ; it tells of no disaster that was not retrieved, of no difficulty that was not surmounted, and the failure of the plan is forgotten in the final deliverance.

An excellent map shows the route of the *Endurance* as a free agent and in the pack, the drift of the floes and the various relief expeditions, so that every incident can be followed and the sense of position is never lost.

The second part of the book runs less smoothly, and there is some difficulty in following the comings and goings of the various parties. The Ross Sea expedition was more successful than that in the Weddell Sea. The landing was made as planned, the whole system of depôts for the relief of the trans-continental party was laid out on the Barrier ice as far as the base of Mount Hope at the mouth of the Beardmore glacier ; and the *Aurora*, though blown from her moorings, escaped with her life and was fit after repair to return and bring back the survivors of the land party. The success of the depôt-laying parties was purchased at a terrible price of suffering, and was clouded by the loss of three lives ; Captain Mackintosh, the leader of the Ross Sea side of the Expedition, perished, and much of his journal was lost with him. Mistakes or

delays were made which left the shore party imperfectly provided for when the ship broke away. Sir Ernest Shackleton observes that it is easy to be wise after the event, and makes no harsh reflections. We can only follow his example. After all, the miscalculations that may have been made, while no doubt adding much to the hardships of the southern party, did not prevent them from carrying out their full programme. Their heroism and devotion were beyond praise, and seeing how narrowly they escaped the fate of Scott's southern party, the fact that they did escape redounds immensely to their credit.

The *Aurora* reached Cape Evans on Ross Island on 16 January 1915, and depôt-laying to the south was started before the end of the month. On 20 February 1915 a depôt was placed in 80° S., the farthest point reached that season, and Mackintosh with five companions was back at Hut Point on March 25, though it was 2 June 1915 before the sea-ice in McMurdo Sound was strong enough to enable him to reach the men left at Cape Evans. The *Aurora* with most of the stores for wintering had been blown away a month before. On 1 September 1915 (when the *Endurance* and the *Aurora* were both drifting north ice-locked in 70° S. on opposite sides of the world) Mackintosh began to sledge stores southward, and on 6 January 1916 he was back in 80° S., proceeding thence with five companions. He and several others developed symptoms of scurvy, but the thought of Shackleton's dependence on the supplies they were hauling inspired them to struggle on, and they laid the depôt at Mount Hope in 83° 30′ S. on 26 January 1916. They little thought that the men of the *Endurance* had never set foot on land, but that they like the *Aurora* had been drifted north beyond the Antarctic circle. The return journey was as full of hardship and risk as any in the Antarctic record. Had the party held together they would undoubtedly have perished as Scott had done ; but starvation was avoided by the stronger leaving the weaker behind while they made a forced march to the next depôt to the north and returned with supplies. Mr. Spenser-Smith, whose condition had long been hopeless, succumbed ; but all the others regained Hut Point on 18 March 1916. The *Aurora* by this time had been clear of the ice for a few days and was heading for New Zealand, while the crew of the *Endurance* had been drifted close up to the South Shetlands; but of course Mackintosh knew nothing of these things.

The death of Mackintosh and Hayward on a premature attempt to reach Cape Evans from Hut Point over the sea-ice was clearly a mere accident due to an error of judgment, and was in no way attributable to the plan of the expedition or to the hardships of polar travel.

The reader is heavily handicapped in following the comings and goings of the Ross Sea party by the want of a map, and we doubt if any one unfamiliar with the earlier expeditions in this area could derive from the text a proper idea of the relative positions of Cape Royds, Cape Evans, and Hut Point, not to speak of the Barrier edge and the depôt stations on the way to Mount Hope. So too the drift of the *Aurora* is left obscure, and little is added to the information derived from the first telegraphic report which was summarized in this *Journal* (vol. **47** (1916), p. 369). Some passages in Stenhouse's abridged log are confused either from the use of technicalities with which we are unfamiliar or from misprints that have escaped correction. That he was thrown unexpectedly into a position of extraordinary danger and responsibility quite accounts for the scant justice he does to his own splendid seamanship in getting the crushed and shattered *Aurora* safe to port. Some sort of chart of

the drift of the ship should have been given in the volume. To our mind the drift of the *Endurance* and of the *Aurora* constitutes the solid claim of this expedition to new discovery.

The courses of the ice-floes moving north off the north-running east coasts of Victoria Land and Graham Land respectively were curiously parallel; at the beginning of May 1915 they were both in 76° S., and by the beginning of October they had both reached or approached 69° S., while at the beginning of the following March both ships were nearly in 64° S. That the floe which wrecked the *Endurance* kept nearly in the same meridian is comprehensible from the fact of the peninsula of Graham Land and the islands which lie off it barring any general westward drift until north of the South Shetlands; but it is by no means easy to see why the *Aurora* was not drifted far to the westward after passing the Balleny Islands. No doubt her positions in longitude are uncertain; but there must be more information in her log than appears in the book, and we greatly desire some such account of the drift of the *Aurora* as was given by Lieut. Wordie of the drift of the *Endurance* (*Geographical Journal*, vol. 51 (1918), p. 210). As Sir Ernest Shackleton promises the subsequent publication of the scientific results of his expedition, we can trust to this important matter being dealt with in the fullness of time. We note a curious oversight in the absence of a list of the *personnel* of the expedition. In referring to individuals the Author rarely gives their initials or indicates their status, whether scientific men, officers, or members of the crew. It would only be fair to all hands that this should be remedied in a later edition, and some notes of their earlier record added.

There are interesting appendices dealing in a popular way with some of the scientific results, and the compression of the work into one volume adds much to its appeal to the general public.

THE ORDNANCE SURVEY AND THE WAR

The Ordnance Survey and the War 1914–1919.— Printed at the Ordnance Survey Office, Southampton, 1919.

NO branch of the Government service has been put to a severer test by the war than the Ordnance Survey; and certainly none has better risen to the emergency, acquitted itself more creditably, or done work of greater importance than that department. The demand made upon it for the production of maps for the use of the armies in France and elsewhere abroad was tremendous and ever increasing, but this demand was fully met, thanks to the able superintendence of the Director-General, and the hearty and energetic support of the officers and staff working under him. Not only was there this large demand for trench and other maps for the various fronts, but a great many maps and charts were prepared and printed for the Admiralty, and for military use at home, besides the keeping up, as far as circumstances would admit, of a certain amount of the ordinary work of the Survey.

A good idea of the work carried out can be obtained from a small volume just issued by the Office at Southampton, a copy of which has been forwarded to the Society, entitled 'The Ordnance Survey and the War 1914–1919.' This consists of the report of the Survey as affected by the war, 4 August 1914 to 21 June 1915; the annual reports for the financial years April 1 to March 31 following for each subsequent year; an account of the Overseas Branch of the

Ordnance Survey (O.B.O.S.); and a brief outline of the growth of Survey work on the Western Front. These are bound together in one volume and prefaced by an interesting introduction by Sir Charles Close, and a Roll of Honour of all members of the Survey who lost their lives in the war. The whole volume is a fitting memorial of the great service rendered to the State by this important Department.

At the outbreak of war the total male *personnel* of the Ordnance Survey, in normal times about half military and half civil, totalled 1940 between the ages of 14½ and 60, and 961 of these were either already in the Army or immediately joined up, 568 being members of the civil staff of the Department.

The war work of the Survey may be classified under the following headings: (1) The supply of topographers, observers, draughtsmen and printers for the various fronts, of whom about 800 were specially enlisted and drafted abroad, in addition to those already in the Department. (2) The drawing, printing and supplying of maps, plans, and diagrams to the Army and Navy, of which the total number amounted to 32,872,000, including those prepared and supplied by the Overseas Branch of the Survey. (3) The supplying of stores, paper, artillery boards and map models. Altogether 12,000 artillery boards and 1000 map models were supplied. The rapidly increasing demands for maps can be learned from the fact that while during the year ending 31 March 1916 4,539,759 maps were supplied, during the similar period ending 31 March 1918 the number amounted to 9,443,506.

An interesting feature of this Report is the account of the Overseas Branch of the Survey. Owing to the constant demand for new editions of trench maps in France, and in view of the delay entailed in depending entirely on Southampton for bulk supplies of these maps, it was decided to establish a branch department at some convenient location in France, and the place selected was Wardrecques. Here during one short period from 22 March to 4 April 1918, whilst the German offensive was in progress, 300,000 maps, involving 580,000 printings, were turned out and sent to the armies concerned, which speaks well for the energy of Lieut.-Colonel W. J. Johnston, who had charge of this department, and of all those working under him. Soon after this, on April 11, owing to the German advance, it became necessary to move this department further from the front, and a site near Boulogne was selected, where its useful operations were continued until the signing of the Armistice, soon after which it was disbanded.

The Report also contains some interesting photographs of the 1st Ranging and Survey Section, and of the Overseas Branch of the Survey.

In his introductory remarks Sir Charles Close states that the total cost of the war work of the Ordnance Survey amounted to £1,454,990, which is less than a quarter of one day's cost to the country of the war in its final stages; and considering the vast importance of the service rendered, a most moderate sum. Probably no war expenditure of anything like the same amount has given such valuable returns.

E. A. R.

TOPOGRAPHICAL SURVEY OF NEW ZEALAND

IT will be especially interesting to many to learn that this Society has recently received the first two sheets of a topographical map of New Zealand, on the scale of 1/125,000. Although a good triangulation of the country has been in existence for years past, no use has hitherto been made of

it for topographical mapping, such maps as have been published consisting chiefly of the black-and-white county maps of the Department of Land and Survey, prepared from cadastral surveys made for the purpose of land subdivision and settlement, but not with any view of representing the topography.

Shortly before the war Lieut.-Colonel C. M. Gibbon, R.I.F., arrived in New Zealand to take up his duties as Chief of Staff, and he soon became impressed with the need of a good topographical survey of the country. He had had previous experience of such survey and mapping in Persia and elsewhere, and with commendable perseverance and energy managed to persuade the authorities of the strategic and general necessity for such a map. With very slight funds at his disposal he set to work, and placed in charge Mr. Kenneth Graham, who, with one assistant and a man to act as cook and assist generally in camp, started on this praiseworthy undertaking. During the war the work was in great measure suspended, owing to other calls on the services of the surveyors, but now two sheets—Auckland and Wellington with their immediate surroundings—have been published in preliminary form. These are both creditable productions, and it is greatly to be desired that the work so well begun shall meet with all the encouragement it deserves, and be brought to a successful completion. Apart from any special military importance attaching to the map, there should be an increasing demand for it for the use of motorists, tourists and others ; so that to a great extent the cost of production is likely to be repaid by the sales as the map becomes known to the public and its excellence and value are appreciated.

The basis of the map is the accurate triangulation already referred to, supplemented by a secondary triangulation, also previously existing, of which the geographical co-ordinates had to be computed. The co-ordinates of these first and second order triangulations were then plotted on the plane-table sheets, together with such roads and other features as could be usefully taken from the existing maps, and the surveyors commenced work in the field. As the topographical survey proceeded, care was taken to check the accuracy of what had been laid down from other maps. The scale on which the survey was carried out was 1/125,000, the same as that on which the sheets are published ; but the contours at 100-feet interval, and the general features of the map from the survey sheets were drawn on photographic enlargements, which were afterwards again reduced to the 1/125,000 scale. The relief is shown effectively by contours in brown combined with neutral-tint shading. Roads are in brown, water in blue, and wooded lands green.

In their general arrangement and numbering these sheets follow the scheme of the 1/M International Map, and it is hoped that combined layer-tinted sheets, with contours and heights in metres, may eventually be published on this scale.

A clinometer, constructed to Mr. Graham's own design somewhat after the Indian clinometer pattern, and an aneroid were used for the contouring, and the contours and all spot heights depend upon the trigonometrical heights of the triangulation stations. The daily rate of survey varied from about 5 to 16 square miles, according to the character of the country ; and the approximate cost of the field survey was sixteen shillings per square mile.

The New Zealand Government, Colonel Gibbon, Mr. Graham, and all concerned may be congratulated on the production of these two sheets. Their publication marks an important advance in the cartography of the country ; it is greatly to be desired that now the war is over rapid progress may be made, and that the neighbouring Commonwealth may be induced to follow the good example thus set by the Dominion of New Zealand. E. A. R.

REVIEWS

EUROPE

The Book of the Lews.— W. C. Mackenzie, F.S.A. (Scot). Paisley: Alexander Gardner. 1919. *With Map and Illustrations. Price* 12*s.* 6*d. net.*

This book is based on the author's 'History of the Outer Hebrides,' now out of print, and consists of a series of historical sketches and three chapters on the pre-historic monuments of Lewis. It is illustrated by a rough sketch-map and a fine series of illustrations, and owes its publication at the present time to the recent change of ownership of the "island"; for the author considers that Lord Leverhulme's schemes are bound to produce fundamental changes in the life of the people, and that the moment is therefore opportune for discussing the influences which have moulded that life in the past.

To the outsider it has always seemed obvious that Lewis is a poor and barren region, whose only important resource is the rich fisheries of the adjacent seas. Always, therefore, when external influence has appeared it has been the fisheries which have proved the attraction. Even the occupation by English troops, from 1653 to the Restoration, is only an apparent exception, for it was the Dutch interest in the fisheries which gave the Western Islands their strategic importance in the eyes of Cromwell. Apart from brief allusions to the fisheries carried on successfully by the Norse, the French and Spaniards, and the Dutch, the author describes in some detail three attempts to exploit this source of wealth by outsiders. These are that of the Fife Adventurers at the end of the sixteenth century, whose objects included "ruiting out the barbarous inhabitantis"; the efforts of the English Corporation, under royal patronage, in 1633, and the later attempts of Charles II. All these efforts failed on account of the active or passive resistance of the "barbarous inhabitantis," and their chief permanent result was that the latter learnt, especially from the Dutch, to improve their own methods and to take a more active part in the fishing industry. So far, then, we have merely an example of a community proving unable to utilize fully its own best resource, and succeeding in preventing its exploitation by outsiders. But though Mr. Mackenzie treats the whole agrarian question with great restraint, he makes it clear that the Lewisman's indifference to the fisheries is partly due to his intense land-hunger, which leads him to prefer the scanty harvest of his few fields to the richer harvest of the seas: neither argument nor economic pressure has hitherto been able to modify this attitude. Further, during one period at least his devotion to the land had an economic justification. In the middle of the sixteenth century Lewis was a "fertile" land, "fruitful in corns," barley being the chief crop. The region was then under the MacLeods, and the people, like the Russian serfs, regarded themselves as the property of the chief, but the land as their own. This sense of ownership has never left them. By the beginning of the seventeenth century the land had passed under the rule of mainland chiefs, the Statutes of Iona gave the people a measure of liberty but the agricultural decline began, and by the end of the century the people and their cattle were dying of hunger. One must regret that to the solution of the problem thus raised Mr. Mackenzie has so little to contribute. But even to have raised it is to have done much, and we must congratulate the author on his success in showing, in a most suggestive book, the closeness of the connection between the life of this Hebridean community to-day and its past history.

M. I. N.

Les Bulgares devant le Congrès de la Paix.— J. Ivanoff. 2me Edition Augmentée. Berne: Paul Haupt. 1919. *Prix* 10*fr.*

This is a curious and in some respects a pathetic book. If we may regard it as an official Bulgarian publication, then it may be said to make only too clear the great difficulties which a peasant state has to face in the complicated modern world. For there is in it no trace of that instinct for statesmanship which seems an essential for survival, and abundant evidence of those qualities which mark out the peasant everywhere as the predestined victim of the man of affairs. The Bulgarian Peace Terms have been much criticized, but if this volume was presented to the Conference, one has to admit that generosity was almost impossible.

The book consists of three parts, an appendix supplementing Parts II. and III., a statistical section and four coloured maps. In Part I. Prof. Ivanoff describes various aspects of Bulgarian national life, and sets forth Bulgarian claims. In Part II. we find a collection of extracts from the writings of non-Bulgarian authors, of very varied nationality, dealing with ethnographical questions, especially the presence of Bulgars in Macedonia and between the Southern Morava and the Tiwek. Part III. is a collection of diplomatic and other documents bearing upon Balkan problems.

In a short preface Prof. Ivanoff sets forth the Bulgarian claims, which are elaborated in the pages which follow. He states that the largest part of the Balkan Peninsula has been inhabited for thirteen centuries by the Bulgarian people. "From the Danube to the Ægean sea, from Lake Okhrida to the Black Sea, this people of 6,000,000 souls forms a geographical entity. . . . Nevertheless the caprices of diplomacy from the Congress of Berlin (1878) to the Peace of Bukharest (1913) shackled their national expansion. At the present time a large part of their lands and of their congeners have fallen again under the rule of the alien. This is why a sacred duty remains to be fulfilled: to give to this people which has suffered so much the possibility of enjoying one day the benefits of civilization and the fruits of its peaceable labours."

The limits of the "Bulgarian entity," and the extent to which the treaties of 1878 and 1913 are to be revised are stated more precisely on pp. 12–13. The western limits of the "Bulgarian nationality" in Macedonia are there given as "the Shar Mountains and Mount Yablanitsa to the west of the Drin, Lake Okhrida and Mt. Grames." From Mount Grames the imaginary line leads to Salonika, Serres and Drama. From the last "it reaches the Ægean, Porto Lagos, Dedeagatch, Enos, then ascends along the Ergene to reach the Black Sea near Midia." But this leaves out "certain important Bulgar oases," some of which are found "even beneath the walls of Constantinople." As to the north-western limit, Prof. Ivanoff speaks with slightly less assurance: "nevertheless it is permissible to conclude that the extreme Bulgarian limits on the western side are, with few exceptions, the valleys of the Timok, of the Nishava and of the Bulgarian Morava." The statement that the Danube forms the northern frontier is not elaborated.

It is clear then that these claims, "incontestably founded upon right and which therefore cannot be renounced," involve a return to the Bulgaria of San Stefano, with some important additions, notably the whole of the Dobruja and Thrace to the Enos-Midia line. They involve, further, the loss both by Serbia and Rumania of territory held since 1878, in addition to that gained in 1913; Greece, also, would lose territory, including Salonika, as well as Turkey, the latter's loss including Adrianople. Thus Prof. Ivanoff demands after defeat and unconditional surrender more than his country could have hoped to gain

from complete victory. Both in his text and in the statistical section also, he casts longing eyes at trans-Danubian territory—"the Bulgars are found in dense masses in Southern Bessarabia, in the environs of Bukharest, and, disseminated in oases of little importance, at other points in the kingdom of Rumania." Even if we suppose that, peasant fashion, these claims were intended to leave a margin for bargaining, they seem to show a notable lack of common sense. Nor can the insistence upon Bulgarian superiority to the Serbs, all things considered, be regarded as tactful. M. I. N.

ASIA

A Guide-book to Northern Palestine and Southern Syria.— Palestine Pocket Guide-books. Vol. 3. Published by the *Palestine News*, and edited by **Lieut.-Colonel H. Pirie-Gordon**. Pp. 154. 7 *Diagrams, Maps and Tables. Price* 20 P.T.

This is the third volume of a guide, of which the first two were reviewed in the Monthly Record for January this year. Like the previous parts this volume is based upon Baedeker's 'Palestine and Syria,' with, however, much additional historical matter particularly as bearing upon Arab and Crusading records. It is avowedly a makeshift guide to topography—the time for an exhaustive travel-guide has not yet come—but the very full historical data will assuredly be most valuable to members of the E. E. F. in Palestine. There is a mass of material gathered together here which is useful to any student of the Holy Land. The section on Damascus is very full.

This volume has also several special features of interest. Firstly, it is provided with by far the best coloured map of Palestine and Syria—from Maan in the south to Latikiya in the north (on the scale 1 : 750,000)—which we have seen in any book. It is reproduced by the 'Survey of Egypt, 1918.' There are, too, small maps on the same sheet on various scales of Beirut, Sidon, Tyre, Damascus, Safed, Acre, Lake Tiberias, Mount Carmel and the Nablus districts. Secondly, there is an Appendix upon the "Emirate of Mecca and the Arab Movement," and three tables of great interest showing descent of the Arab clans from the family of Mohammed, and especially the claims of King Husein to the Khalifate of Islam. And lastly there is an important "Sketch of the Topography and Geology of Palestine" by Major R. W. Brock, R.E., which is in parts an original contribution to our knowledge. Especially interesting is the section on 'the Late Geological History of the Ghor,' where Major Brock makes interesting original observations regarding Jebal Usdum. With regard to "volcanic rocks" the writer is not apparently on such sure ground, as it is not literally correct to say that the Lake of Tiberias "in fact has basalt on all sides of it," nor that "the most important mass of basalt on the west is Jebal Safed." There are a few small outcrops of lava in places, but the great mass of Jebal Safed consists of soft limestone with belts of flint.

The Guide-book as a whole is a most useful piece of work, and of interest to the general reader as well as to those for whom it has been specially compiled.

E. W. G. M.

With the Persian Expedition.— **Major M. H. Donohoe.** London: Edward Arnold. 1919. *Illustrations.* 16*s. net.*

We welcome this book, which gives in an interesting form the first account of one of the adventures of the war, in which Major-General Dunsterville operated against the Turks at Baku across north-west Persia with scarcely more than a handful of officers and men.

Starting from Baghdad, Dunsterville motored across famine-stricken Persia with little more than his staff, and at Resht on the Caspian Sea attempted to impose his will on the Bolsheviks and their Persian auxiliaries, many of whom were drawing German pay. At first he almost succeeded, but finally he was forced to retreat to Hamadan. His second attempt which aimed at holding Baku with the aid of the Armenians also failed, but yet constitutes an honourable incident of the Great War.

The difficulties experienced by General Dunsterville, not only from Persians, Russians, Armenians and the enemy, but also in quarters where support and sympathy might have been expected, are detailed in Major Donohoe's work. In the latter part of the book an interesting account is given of the British attempts to keep the Turks from penetrating into the heart of Persia; and the idiosyncrasies of the Kurds are also dealt with in a sympathetic manner.

From the geographer's point of view little information is actually given, but we realize that geographical work was done, and we realize too that Major Donohoe thoroughly enjoyed the many strange experiences which he underwent in the wilds of Persia. The map does little credit to the publisher, but the illustrations are not devoid of interest.

AFRICA.

The War in Africa, 1914–17, and in the Far East, 1914.— H. C. O'Neill. London: Longmans & Co. 1919. Pp. ix. and 114. *Maps and Illustrations.* 3*s.* 6*d. net.*

Three Years of War in East Africa.— Capt. Angus Buchanan, M.C. London: John Murray. 1919. Pp. xxi. and 247. *Maps and Illustrations.* 12*s. net.*

Mr. O'Neill gives a summary account of the conquest of the German oversea possessions. It was a good idea to survey in one volume the campaigns in Africa and the Pacific, and the author has done his work carefully. The story is not free from blemishes; it is inaccurate, for example, to say that the "bulk" of Kamerun was ceded to Germany by King Bell in 1884; nor was it General Stewart, as stated on p. 83, who advanced from Moshi down the main road to Kahe. The 1917 campaign in East Africa is rather too scantily treated, and it would have been more satisfactory if the scope of the book had included the 1918 campaign in Mozambique.

The author is to be congratulated on his maps, which are very clear and cover the whole of the German protectorates. Those of Kamerun, South-West, and East Africa show also the route of the different columns with dates of engagements.

In 'Three Years of War in East Africa' Capt. Buchanan has given a vivid account of the campaign as he saw it. He follows the fortunes of his own battalion, the 25th Fusiliers (Legion of Frontiersmen), a unit which was in the thickest of the fighting and won great distinction. But it is not a formal military narrative; indeed, the author is silent on points about which he must have interesting information. Capt. Buchanan is, however, a naturalist and traveller as well as a soldier, quick in observation and in acquiring the atmosphere of a country, and a great merit of his narrative, in which the reader's attention is held throughout, is that he leaves a picture of East Africa in the mind, both full of colour and accurately conveying its essential features. We have noted only one slip, where on p. 124 the author states that Tabora is the "interior terminal" of the Central Railway.

Lord Cranworth, one of the early settlers in British East Africa, writes a preface in which he pays tribute to the great value of the 25th Fusiliers as a fighting unit in upholding white prestige at a time when most of the European troops had been withdrawn. F. R. C.

AMERICA

Santo Domingo.— Otto Schoenrich. New York: The Macmillan Company. 1918. *Illustrated.* $3.00.

The author of this survey of the fate of one of Spain's oldest colonies in the New World has had more than a passing acquaintance with the Caribbean. It will be remembered that Judge Schoenrich officiated for several years in Porto Rico, subsequently spending a term in Nicaragua as one of the American officials of the Mixed Claims Commission. He writes in a colloquial style, the volume setting out to give a résumé of the history of the island that was once an Arawak stronghold, was famous for three centuries as Española, and was later divided by an arbitrary line into Santo Domingo and Haiti.

The historical sketch begins with the landing of Columbus and comes down to the military occupation of the republic by United States forces in 1916, a condition still existent. Events occurring since the book was written render premature, to say the least, the author's statement that "absolute order and security" were thus established, but this is not the only sentence showing that Judge Shoenrich was unable to avoid the temptation of special pleading. He foresees the possibility of "outright annexation" by the United States, but thinks that a protectorate would suit Americans better, since such a status would "carry the advantages of annexation without its responsibilities." It does not seem to have occurred seriously to him that Dominicans could or should be masters in their own house.

Chapters follow upon the area and boundaries of Haiti and Santo Domingo, the topography and climate, geological conditions, flora and fauna—inadequately treated—the racial characteristics of the inhabitants, religion, education, literature (practically merely a list of existing newspapers), transport systems, a survey of principal towns, debts and finance, law and justice, and governmental forms prior to American intervention.

The section dealing with the fate of the bones of Columbus is a compilation of the evidence upon the subject which, although not new, has the merit of being less perfunctory than many other parts of the book.

As a whole the volume suffers from the flaws of most works whose object is, at bottom, that of making out a case, and, while Judge Schoenrich is fortunate in possessing a more facile style than that displayed by Dr. Munro in his book on Central America, lately reviewed in the *Journal*, the fact that both publications belong to the order of propaganda does much to destroy their interest for the student or the general reader. L. E. E.

POLAR REGIONS

With the "Aurora" in the Antarctic, 1911–1914.—John King Davis. London: Andrew Melrose, Ltd. Not dated [1919]. Pp. xxii., 184. *Plates.* 18*s. net.*

Although the narrative of the Australian Antarctic Expedition has been set forth in the two stately volumes of 'The Home of the Blizzard' by the leader Sir Douglas Mawson, there was room for this modest little book by the able navigator who commanded the ship of the Expedition. So far as exploration is concerned, leaving scientific research out of sight for a moment, there were

two circumstances which made the Australian expedition unique: Mawson's terrible march across the inland ice to his main base after the death of both of his travelling companions, and Davis's relief of Wild's party at the Western Base. Both were dealt with in 'The Home of the Blizzard,' but only a sailor could deal adequately with the momentous voyage and the sudden calls for swift and inalterable decision which created dramatic situations as acute as any in the history of exploration. The reader who expects thrills will however search these pages in vain. As none but a sailor could have written the book, none but a sailor can adequately interpret it. Captain Davis recites the incidents of his three voyages with scrupulous care and with uniform precision, but there is no play of the literary limelight to focus attention on critical moments or desperate situations. A sailor knows all that is implied in the loss of every anchor on board a ship, and so can understand how Captain Davis must have felt while grimly holding his own against the terrible gales in the ice-encumbered sea at Commonwealth Bay, waiting to the last permissible hour for news of the return of his leader to the Main Base. But from the matter-of-fact reference to anchor after anchor being lost or broken, an ordinary reader who had not yet grasped the stern simplicity of style might almost fail to see that the case was more serious than the smashing of tea-cups. It is so all through the log of the *Aurora*, nothing is set down that is not important, but the fact of the importance of each statement is never shouted at the reader. The book is one to ponder over rather than to skim through, and the more one thinks over the sometimes stiff sentences the more one realizes how true a successor of the old sea-giants of exploration we have in John King Davis.

The condensed text is helped by an admirable selection of well-reproduced photographs, and still more by a wealth of sketch-maps which enables one to follow every twist and turn of the track along the ice-edges or through the floes. Due record is given of the deep-sea soundings and trawlings by which these voyages enriched science, but here again no one who has not attempted to handle sounding machines and trawls on a small vessel in heavy seas can realize what a world of anxiety, watchfulness and seamanship is involved in an operation the success or failure of which is recorded in a line of print.

Three short supplementary chapters deal with the coastal line of pack-ice, the D'Urville Sea and a comparison of the tracks of the *Vincennes* in 1840 and the *Aurora*. Captain Davis justified Wilkes's report of the "appearance of land" he charted as Termination Land through the *Aurora's* discovery of the great Termination ice-tongue, which presents not only the appearance of land to a seafarer but acts exactly like land on the currents carrying the floating coastal ice. H. R. M.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

Technical Papers, No. 1. Approximately Rigorous Adjustment of Simple Figures.— Capt. G. T. McCaw. Issued by the General Staff. London: Published by His Majesty's Stationery Office. 1919. 53 pp. *Price 2s. 6d. net.*

One result of the conclusion of the Great War will be a considerable increase in the work of Boundary Commissions involving the observation and reduction of triangulation, and any surveyor who has been engaged on such work will appreciate the advantage of being able to arrive on the spot at an adjustment of the errors of observation sufficiently rigorous to enable definitive results to be

stated and the work carried on without the long delays involved in employing on national surveys the absolutely rigorous methods usually worked out at leisure "in recess." The methods explained in this pamphlet are to divide the triangulation into simple figures involving only one "side equation." The angle equations are first adjusted separately, and rules are given for writing down almost at sight the angular corrections for polygons up to eight sides. After adjusting the angle equations in this way the side equation is adjusted. This latter adjustment will generally upset slightly the previously obtained angular corrections, and the angle equations should, strictly speaking, be again solved using the new residuals as errors. In general, however, the residuals after solving the side equation will be so small that it will be possible to disperse them by arbitrary corrections at sight. Though described as approximate, it can be shown that this method when continued leads to the same result as a simultaneous solution of all the equations ; and it has even this advantage over the latter, that the computer can watch the effect of the different conditions on his corrections, so that, for instance, if the side equation should involve a large change in any one correction, it might point to some source of constant error in that angle, or even a blunder in observing or reducing it, which on examination of the records might be detected.

Captain McCaw has produced a clearly written and very useful pamphlet which should prove of great assistance to the officers who will be employed on the boundary work in question, and we shall look forward to the issue of further numbers of these technical papers of the General Staff. A. E. Y.

A Handbook of the Prismatic Astrolabe.— **John Ball, O.B.E., D.Sc. (Lond.)**, of the Survey of Egypt, and **H. Knox-Shaw, M.A., F.R.A.S.**, Director of the Helwain Observatory. Published by the Egyptian Government. Cairo : Government Press. 1919. To be obtained, either directly or through any bookseller, from the Government Publications Office, Old Ismailia Palace, Sharia Qasr el 'Aini, Cairo. *Price P.T.*50 *or* 10*s.* 6*d.*

In the paper on the Prismatic Astrolabe published in the *Geographical Journal* for July last, reference was made to the handbook on the use of the instrument which Dr. J. Ball and Mr. H. Knox-Shaw, the authors of the paper, have prepared, and which has recently been published at Cairo by the Egyptian Government. A copy of this has now been received by the Society, and should be consulted by all who are thinking of determining positions by this new instrument. The Prismatic Astrolabe, or *Astrolabe à Prisme*, as its French name is, is now pretty well known ; but perhaps the chief reason why it has not been more generally used by British surveyors has been the want of a good text-book.* This lack Dr. Ball and Mr. Knox-Shaw have now supplied. And they have done more, for their handbook not only contains an excellent illustrated description of the instrument, the adjustments and instructions for use in the field, but gives a new, and partially graphic, method which they have devised of obtaining the results of the observations, and which, while accurate, is extremely simple and much reduces the work. This method was referred to briefly in the paper before mentioned. The preparation of the programme beforehand is also much simplified by the publication, at the end of the handbook, of an extensive table of stars which, between lat. 55° N. and 55° S.,

* It may be admitted than the pioneer text-book by Messrs. Claude and Driencourt, the inventors of the instrument, was rather difficult, and made the method a little formidable.

attain the altitude of 60° in quadrants suitable for observation; with the magnitude of the star, the local sidereal time, and their azimuths. This handbook will be invaluable to geographical surveyors who intend to use the Prismatic Astrolabe in the future. E. A. R.

Shore Processes and Shore-line Development.— Douglas Wilson Johnson. Pp. xvii. + 584. 74 *photographic plates and* 149 *text-figures.* New York: John Wiley & Sons. London: Chapman & Hall. 1919. 23*s. net.*

Prof. Johnson's beautifully illustrated book has the character of thoroughness which we expect from the American school of physiographers. Three preliminary chapters deal with wave-motion, wave-action and current-action, by which shore-features are so largely determined. In chapter IV., a standard terminology for shores is proposed. A distinction is drawn between *shore* and *coast*, *shore-line* and *coast-line*. The *shore* is "the zone over which the water-line, the line of contact between land and sea, migrates": its lower limit is the *shore-line* (more precisely, the low-tide shore-line), its upper the *coast-line*, while the high-tide shore-line divides it into *foreshore* and *backshore*. The *coast* is an indeterminate width of the land within the coast-line. Seaward from the shore comes first the *shore-face*, the "narrow zone over which beach sands and gravels actively oscillate," followed by the *offshore*, which extends to the edge of the continental shelf. Three surfaces of abrasion are recognized: the *cliff*, the *bench* (occupying all the shore and most or all of the shore-face) and the *abrasion platform*. The material deposited on the shore and shore-face is the *beach*, that on the abrasion-platform is the *veneer*, and farther out is the *continental terrace*.

This is not the place for a detailed consideration of these terms, but one comment may be made. The term "offshore" leads to ambiguity in its adjectival use: "offshore currents" are currents in the offshore zone, and their direction is, or may be, parallel to the shore (see Fig. 51), while offshore winds are directed at right angles to it.

Shore-lines are classified into those of submergence, those of emergence, neutral and compound; and careful studies of the features of these in their youth, maturity and age are given, illustrated by stereo-diagrams and actual maps and views. This takes up the bulk of the book, the last two chapters being devoted to shore-ridges and minor shore forms (ripple-marks, etc.).

The author is so careful in acknowledging the work of others, whether he accepts or criticizes their results, that a casual reader might fail to realize the large amonnt of original work that is embodied in the book. Among original points of special interest may be mentioned his study of the relation of beach-drifting to winds, in which he shows that the length of open water over which a wind blows on to a lee shore is of the greatest importance—a theoretical conclusion very prettily confirmed by the case of Lake Michigan. English geologists will be interested to find that the importance of planes of marine denudation, rather discredited by the enthusiasts for subaerial planation, is rehabilitated by Prof. Johnson.

In another respect British readers may meet with a disappointment. If they seek through this book for any reference to such beautiful effects of marine denudation on rocks of unequal resistance as abound along their own southern and western coasts, they will find them disposed of in one sentence: "A mature coast should therefore show simple but distinct curves systematically related to rock-structures" (p. 344). To their protest Prof. Johnson

would probably reply that these are features not of the shore-line but of the coast-line, and need another book for their treatment.

The book is illustrated by a beautiful series of seventy-four full-page photographs, of which almost as many are from the Old World as from the New, and many diagrams and maps. The last have no scale, and sometimes (*e.g.* Fig. 115) omit place-names referred to in the accompanying text. These imperfections, as well as some misprints, are probably to be accounted for by the author's departure on military service before the completion of the book, and make a very small detraction from its great merits. A. M D.

Climate: Considered especially in Relation to Man. Robert De Courcy Ward. 2nd edition, revised. New York and London: G. P. Putnam's Sons. 1918. Size 8½ × 5½, pp. 380. *Illustrations and Maps.* *12s. 6d. net.*

The second edition of the standard American work illustrative of the effects of climatic control has been revised in the light of recent knowledge, as, for example, in the parts which deal with the polar regions. Some of the chapters have considerable practical utility; and we think that the English-reading world should be grateful to Prof. Ward for his sound guidance in matters pertaining to the general unsuitability of tropical climates to the health of those of European stock. It is the more to be valued in face of the fact that professional men, in pressing the point that certain specific diseases may be nearly eradicated from hot countries by the adoption of stringent sanitary measures, are often apt to overlook wider medical issues as affecting the welfare of individuals, or of races, in unwholesome regions.

Two much space is allotted in a work of permanent academic value like the present to the classification of climatic types on a detailed plan. The uncompromising facts of nature and the ubiquitous presence of transitional or overlapping phenomena simply defy all attempts at systematic, detailed classification, and it should never be forgotten that the art of classification is nothing more than an expedient for the marshalling of knowledge to serve particular, and often quite temporary, purposes. L. C. W. B.

THE MONTHLY RECORD

EUROPE

The New Boundaries of Bulgaria.

WE had hoped to publish in this number of the *Journal* a full account of the new boundaries of Bulgaria according to the Treaty signed at Neuilly on November 27 last. A copy of the 1/M map attached to the Treaty was received on December 13 through the courtesy of the War Office, and is exhibited in the Map Room; but nearly a week later the final text of the Treaty was still unavailable, and we are therefore compelled to defer any detailed discussion of the boundaries until the February number. Meanwhile it is possible to say from the examination of the map that no considerable changes have been made since the approximate course of the boundaries was communicated to the Press some months ago. Bulgaria loses to Serbia four districts of no great size on its western frontier: firstly, a part of the eastern side of the valley of the Timok nearly as far south as Zayechar; secondly, a strip of the upper basin of the Nishava, including the town of Tsaribrod; thirdly, a portion of the upper basin of the Dragovishtitsa and the district of Bosilegrad; and fourthly, the salient at the south-west corner, including the town of Strumitsa.

These losses of territory are small in extent, though they are much bewailed in the "Observations of the Bulgarian Delegation on the Conditions of Peace with Bulgaria," which has recently been received anonymously through Holland. The most serious loss to Bulgaria is the strip of Ægean coast which they obtained by the Treaty of Bucharest, 1913. Their boundary is now set back to the watershed between the basin of the Maritsa on the north and the small rivers running direct to the Ægean on the south. Thus the railway between Salonika and Constantinople through Drama and Gumuljina will be entirely in the hands of the allied and associated powers. The boundary in the Dobrogea remains that of 1913.

We hope to publish in the February number a map on the scale of 1/2M, with a full discussion and text of the geographical clauses of the Treaty.

ASIA

The Campaign in Palestine.

In the review of 'The Advance of the Egyptian Expeditionary Force,' p. 315 of the November number, 1919, the wish was expressed that some intimation had been given as to where the work could be purchased in England. We are informed by Messrs. Stanford that the work is published in this country by H.M. Stationery Office, and that copies may be had from themselves. The copy reviewed gave no such indication.

Erratum in December number, 1919.

Major Mason's paper on Central Kurdistan. In the sketch-map published on page 332 the black line is erroneously described as the author's route. It is intended to represent the route of the roads he proposed in his lecture.

AMERICA

The Mexican Territory of Quintana Roo.

The southern and eastern part of the Yucatan Peninsula, in great part a wilderness and sometimes known as Los Despoblados, has for some years been separated from Yucatan proper (in the north-west of the peninsula) to form the territory of Quintana Roo. It is probably the least-known and most undeveloped part of all Mexico, the only inhabitants for the most part being bands of intractable savages (Mayas) who live by the chase. With a view to examining its products and general capabilities an expedition was sent to the territory in 1916-17, under Signors Pedro C. Sánchez and Salvador Toscano, who give an account of their investigation in the *Memorias* of the Sociedad Cientifica "Antonio Alzate," vol. 38, Nos. 5–8 (June 1919). After coasting along the low and arid shores of Yucatan, which are hardly distinguishable from the water, and passing the equally arid Isla de Mujeres, which seems likely in time to fall a prey to the destructive action of the waves, the voyager going south hails with pleasure the verdant island of Cozumel, whose limpid waters permit a view of the abundant marine life of the sea-floor, and which may in time become a miniature Cuba. South of it the numberless reefs and the violence of the swell render navigation difficult and dangerous, and the expedition was forced to take shelter at Belize before proceeding to the settlement of Payo Obispo, founded in 1899 on the Bay of Chetumal, whence the investigations were to be begun. The place had only the year before suffered severely from a terrific hurricane, which had also devastated much of the north-east of the territory. The country along the frontier of British Honduras was examined by way of the Rio Hondo, which forms the common boundary. The *Casa Mengel* has here a considerable establish-

ment for the exploitation of the timber of the forests. The report draws attention to the obstacles to development caused by the way in which the boundary with British territory is drawn, this involving the transit through the latter of all goods descending the river. A movement has been set on foot for the construction of a railway to supply an outlet to the bay of Espiritu Santo, free from this inconvenience. A route was examined by way of the Bacalar lagoon, on which was founded in 1733 the old Spanish city of Salamanca, now deserted, and the travellers could assure themselves of the importance of the forests as sources of timber-supply and the collection of *chicle* gum, the product of one of the *Sapotaceæ*. A high opinion seems to have been formed of the fertility of the region, and the prospects offered for the cultivation of tropical products, as to which the report of Sir David Morris on British Honduras is said to apply equally to the adjacent Mexican territory.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

The Nature of the Earth's Interior.

In a paper read before the Royal Society of Edinburgh (*Proceedings*, vol. 39, 1919, pp. 157–208), Prof. C. G. Knott examines, with greater precision than has hitherto been possible, the bearing of seismographic observations on the nature of the earth's interior. His conclusions, which are broadly similar to the views advanced by Mr. R. D. Oldham in 1906 and further developed last year (see *Journal*, vol. **54**, p. 64), are that the Earth consists of an elastic solid shell down to a depth of about half the earth's radius, that at this depth the rigidity begins to break down, and that, at a depth of six-tenths of the Earth's radius, the distortional waves are quenched, indicating that the elastic solid shell gives place to a non-rigid nucleus of measurable compressibility.

GENERAL

Acquisition of Valuable Early Maps.

The Society has been fortunate in securing for its collections two bound folio volumes of Miscellaneous Early Mops which are of quite exceptional interest for the number of scarce examples which they contain, many of them from the Dutch School of Cartography in its earliest period. The volumes come from the library at Chadacre Hall, near Bury St. Edmunds (recently sold by auction), the books in which are said to have been mostly collected during the eighteenth century by members of the Hallifax family.* The endorsements and other MS. writings on many of the maps seem to indicate that many at least were brought together at a still earlier date, possibly the early part of the seventeenth century, but their binding together in their present form may no doubt have been somewhat later, though still anything but modern. The arrangement shows no particular system, general maps of the world or the continents being interspersed with special maps of the English counties, from Saxton and others. Of the Dutch-Flemish maps many are well-known examples from the Atlases of Ortelius, Mercator, Hondius, and Janssonius; but others represent a class of maps of much greater rarity, hardly known at all until within recent years, or existing only in quite a limited number of copies. Two such are to be found among the first few items of the smaller but more important of the volumes, namely

* According to the D. N. B., Thomas, elder son (born 1774) of Sir Thomas Hallifax, Banker and Lord Mayor of London, resided at Chadacre Hall. In 1781 the father was engaged in a suit with the parish of Bury St. Edmunds for refusing to serve as church-warden.

Hondius's world-map of about 1595 showing Drake's route, hitherto supposed to be represented only by the British Museum copy, and the same author's "Christian Knight" Map of about two years later. In Blaeu's world-map of 1606, on Mercator's projection, we have one of the earliest efforts of that prolific cartographer, eventually included in the first issue of the Atlas in 1635. Round the margin are illustrations somewhat after the style of the great maps of himself and Hondius: these have been cut off in the British Museum copy. There is also a World-in-Hemispheres of 1607 by Hondius's kinsman and coadjutor, Petrus Kaerius, mainly a copy of Peter Plancius's smaller map of 1594. Other early maps by Blaeu and Kaerius are of "Comitatus Hollandiæ" (1604) and Germany by the former, and of Denmark and Italy by the latter, three of them with pictures round the sides. Still less known than these are a series of maps by the Haarlem engravers and publishers, Joannes and Baptista à Doetecom (Duetechum), including one of the Netherlands of 1588, of which a copy lately found at Amsterdam has hitherto been spoken of as unique. Another, a very detailed map of Hungary, bears the date 1596, whilst one of France, engraved by Baptista à Doetecom and published by Vrints, is of 1592. An interesting specimen also is one by Joannes à Doetecom illustrating the Acts of the Apostles, with engraved scenes at the top and bottom. An elaborate map of Denmark with inscription in honour of Henricus Ranzovius (also eulogized by Mercator) is unsigned, but dated 1585. The earliest dated map in this group is one of the Netherlands by the famous engraver Franciscus Hogenberg, dated 1578.* At the top are pictures of whales said to have been taken near Antwerp and in Holland in 1577. The collection includes the original "lion-map" of the Low Countries, made (by Hogenberg?) in 1583 to accompany the work by the Austrian historian Michael Eytzinger "De Leone Belgico," published at Cologne. In these maps the figure of a lion is drawn so as to closely correspond with the outline of the country. In this specimen the north is at the top, and the lion is "rampant," its head occupying northern Holland, whereas in later copies the west was at the top, and the lion's head coincided with Flanders, the position being here "couchant." A quaint conceit in another map is the representation of the world within a fool's cap, with caustic or cynical quotations all round. To the provenance of this we have found no clue.

The earlier English maps are mostly of English counties, from Saxton and Speed, but with one of Surrey which possesses a special interest, as being the first engraved issue of John Norden's map of 1594, referred to by Gough in his 'British Topography' (1780, vol. 2, p. 261), but long supposed to have been lost. Norden undertook the first general description of England by counties, and made a personal survey of those round London, but published descriptions and maps of Middlesex (1593) and Herts (1598) only. His maps of other counties were however included in Camden's 'Britannia' in 1607, being engraved for this purpose by William Kip. The "Surrey" included in the present collection was drawn by Norden in 1594, and engraved by Charles Whitwell at the expense of Mr. Robert Nicolson. In the corner are the arms of (Sir) William Waad, who held important offices under Elizabeth and James I., and was knighted in 1603. As he appears on the map merely as "armiger" (esquire), the engraving of the map must have been earlier than 1603, even if the date 1594 refers to the original drawing only. Like Norden's maps of Herts (and

* For a sketch of the work of Franciscus Hogenberg and his brother Remigius see Colvin: 'Early Engraving and Engravers in England' (1908), pp. 23–26. Franciscus engraved many of the fine maps of Ortelius.

Middlesex?), it is divided up into squares with side of 2 miles, but is on a somewhat larger scale, each mile measuring $\frac{1}{16}$ of an inch. If statements of modern writers, that this map has been "missing" in modern times, are correct, the copy now brought to light will possess an unique interest. Lastly, among the greater rarities in the collection is a copy of the first issue of Captain Smith's famous map of Virginia, originally published in 1612 to accompany a short general description of Virginia. This work, with or without the map, is now excessively rare (the Huth Library copy, with map, sold in 1918 for £220), and even later issues of the map, used in 1624 and 1625 to illustrate Smith's later work on Virginia and Purchas's 'Pilgrimes' respectively, are not often met with. That the present copy is of the original issue is shown by the absence of the page numbers, added later to indicate its intended position in the works mentioned, and by other slight differences.

The other volume is of somewhat less interest, as it consists mainly of the coast charts from De Wit's atlas of *circa* 1670. They are, however, particularly brilliant impressions, and are excellent specimens of the art of engraving in Holland in the later seventeenth century. The rest of the volume consists chiefly of plans and representations of contemporary battles and sieges, of more interest, no doubt, to the historian than the geographer.

Donations towards the Purchase of Early Maps.

The purchase of the above collection, following so soon upon that of the great Hondius map of 1608, has necessarily strained the normally available resources of the Map Department, which in themselves hardly admit of the acquisition of such rarities at all. Generous help towards the recent abnormal expenditure has been given by Lord Glenconner, who has contributed £20 towards the cost of the present collection, and by Messrs. H. Yates Thompson and W. A. Cadbury, who have each given £10 towards the cost of the Hondius map. Further contributions by Fellows and others interested in such documents would be cordially welcomed.

Practical Geography Note-books.

In the list of recent literature given as Supplement No. 3 to the *Geographical Journal* the price of the above note-books, by Franklin and Shearmur, was erroneously given on p. 90 as *6s. net.* The correct price is *6d. net.*

OBITUARY

Lord Peckover.

In Lord Peckover of Wisbech, who died on 21 October 1919, in his ninetieth year, the Society has to lament the loss of one of the scanty band among its Fellows whose election dates back to the fifties of last century—a decade which saw the addition to its membership of names like those of Sir Clements Markham, Alfred Russell Wallace, Sir John Kirk, Sir Richard Burton, and Captain Speke. With the sole exception of the Earl of Ducie, elected in 1851. Lord Peckover, who joined in 1853, had of late been the oldest surviving member of the Society. He will be particularly remembered as a generous donor to the Society's library, two at least of its most valuable possessions in the way of rare books having come by gift from his own collection. A direct descendant of Edmund Peckover of Wisbech who served in Cromwell's army, he was himself born at Wisbech in 1830, and was long a partner in the bank

of Gurney, Peckover & Co. From 1893 to 1906 he was Lord-Lieutenant of Cambridgeshire, and in 1907 was raised to the peerage as Baron Peckover of Wisbech. He had long been a connoisseur in ancient MSS. and maps, of which he brought together quite a remarkable collection, his set of the early issues of Ptolemy's geography being particularly fine. In 1905 he made the generous offer to the Society to present to its library any of these editions, or of kindred works on the early history of geography, which it did not already possess, and needless to say the offer was eagerly and gratefully accepted. An account of the chief treasures so obtained was given in the *Journal* for August 1905, the two most important being the copies of the 16th-century 'Lafreri's Atlas,' and of Berlinghieri's metrical version of Ptolemy of about 1480. The former is specially interesting as being one of the comparatively few copies with the engraved title-page showing Atlas supporting the world.

William Spotswood Green.

We regret to record the death, which occurred on 22 April 1919, of the Rev. W. Spotswood Green, C.B., a Fellow of the Society since 1886, and known to geographers especially for his mountaineering exploits in the same decade, including the first successful ascent of Mount Cook, the culminating summit in the New Zealand Alps. His ascent, and other explorations in the same region, were described at a meeting of the Society in January 1884 (*Proceedings*, N.S., vol. **6**, pp. 59 *et seq.*), and almost simultaneously in a narrative in book form, 'The High Alps of New Zealand.' His next field of adventure was the then equally little-known range of the Selkirks in Canada, the inner recesses of which he did something to explore in 1888, giving a vivid narrative of his experiences before the Society early in 1889 (*Proceedings*, N.S., vol. **11**, pp. 153 *et seq.*, and later in book form under the title, 'Among the Selkirk Glaciers' (1890)). A good many years later he again came before the Society with a most interesting account of the wrecks of ships of the Spanish Armada on the Irish Coast (*Journal*, vol. **27**, pp. 428 *et seq.*), a subject to which he had devoted much careful research.

Green was born in 1847, being the only son of Charles Green of Youghal, co. Cork, J.P. He was educated at Trinity College, Dublin, taking his B.A. degree in 1871. Ordained in 1872, he was incumbent of Carrigaline, co. Cork, from 1880 to 1889. He then began perhaps the most important part of his life-work as Inspector of Irish Fisheries—a post for which his knowledge of and sympathy with the Irish fishermen eminently fitted him, though he made no claim to approach the subject of fisheries from the strictly scientific side. Prof. J. Stanley Gardiner, who saw a good deal of Green in connection with his public duties, particularly as a fellow-member of the Treasury Fishery Committee of 1907–08, kindly contributes the following reminiscences: "I met him first in the north of co. Mayo in 1892; he had just come round from Westport with Horace Plunkett. The latter was rather in despair, but Green was full of hope, although he had apparently had by far the worst reception, because the idea of exchanging the local skin boat or coracle for a wooden boat did not appeal to any of the local fishermen. The notion of a pier however, behind which the boats could be drawn up even in a heavy swell without damage, was the notion he brought round when he came a second time in the following year, when he really made this 'congested' part of Mayo—by this suggestion, by chaff, and inexhaustible patience—believe that the Government really did care about its people's welfare. I saw the rise of Valentia, the various measures set on foot for trawling and drifting fleets, the way the people were taught to use ice and salt and to market their fish, the building of

innumerable piers in the succeeding fifteen years. I believe I am correct in saying that ninety-five per cent. of the ideas were Green's own, and about the same percentage were successful. We can scarcely subscribe to the 'spoon-feeding' that these ideas entailed, but Green was an Irishman, and there was nothing in any of them that would seem out of the way to the people concerned. He treated them as children—his own children."

Speaking of the work of the Treasury Committee, Prof. Gardiner writes: ". . . He did not seem to me to always understand the real meaning of the scientific evidence, but he had a way of his own of putting all the evidence of any witness together, by this means forming his own opinion of the witness: this done, the witness's evidence was either accepted or completely forgotten." He concludes: "Green was to me always a charming and most lovable personality; he had an immense sympathy and a real sense of humour. He was a splendid seaman and one of the pluckiest people I have met."

Major A. E. Steel, D.S.O., R.F.A.

One of the latest victims of the war is Major E. A. Steel, known to geographers chiefly for his boundary-survey work in Africa, who died on the Russian eastern front towards the end of October 1919.

In 1911 Major Steel was selected to join the Anglo-Belgian Commission, which was at that time engaged in demarcating the boundary between Rhodesia and the Belgian Congo; and when Major Gillan, the Chief British Commissioner, was invalided home, he took charge of the section of the line from about long. 29° to the Portuguese frontier at long. 24° E., a distance of some 530 miles. He prosecuted this very arduous work with great zeal and ability, and brought it to a successful conclusion in time to enable him to reach England in July 1914. He gave an account of his work before the Society on 18 June 1917, in the paper "The Zambezi–Congo Watershed."

Major Steel served with his regiment in France until finally incapacitated by wounds from further active service in the field. He was wounded three times, and was awarded the D.S.O. Ultimately he recovered sufficiently to be adjudged fit to go to Vladivostok, and thence to Admiral Kolchak's head-quarters, as Head of the Artillery Section of the British Military Mission. He died from lung trouble following upon typhus, acting on a frame already weakened by wounds. By his death the British Army loses a very capable officer and good surveyor. W. C. H.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1919–1920

Second Evening Meeting, 17 November 1919.—The President in the Chair.

ELECTIONS.—Captain Goodman Ambler, M.C., Royal Sussex Regt.; Miss Mercy Ashworth; Hector George Austin; Lieut. G. W. G. Baas, R.F.A.; Alec. Joscelyne Bamford; J. Lionel Barber; Lieut.-Commr. John Maurice Barbos-Pougnet, O.B.E.; William Henry Barker, B.SC.; J. Edmestone Barnes; Captain R. Bellis, R.N.; Commr. J. K. B. Birch, R.N.; Captain Frank Burnett Blackie; Dr. Manoel de Carvalho Britto; Lieut. Edgar William Buchanan, R.N.; John Major Bull; Edwin Sterland Bunting; Edgar Allison Burrows; Rev. John Francis Carter; Lieut. Dennis Arthur Casey, D.S.C., R.N.R.; Mrs. Mabel E. Cater, B.A.; Miss Lily Cameron Christison; Captain Percy Warwick Clemens, R.E.; Frederick Moore Clements, J.P.; Arthur J. Clevely; Captain J. Matthew F. Cope, Royal Marines; Albert Edward Cradick, B.A.; C. A. Cuttriss; Josiah Davis; Rev. William Edgar Woodhams Denham; Mrs.

Isabel Dixon; Percival Edwards, B.A.; Colonel W. Ewbank, C.I.E., R.E.; George Farmer; Miss Dorothy M. Forsaith; Miss Edith Goodyear; Miss Marie H. Greenway; Edwin Hall, J.P.; Frederic M. Halsey; Rev. Thomas Philip Hampson; P. J. Hannon; James Gordon Hare; Sir Somerville Head, Bart.; Colonel Guy Heseltine, Coldstream Guards; Richard Thomas Hird; Henry Audibert Huggins; J. de Graaff Hunter, M.A.; Captain Christopher Martin Ingoldby, R.A.M.C.; Prof. John Charles Johnson, M.A.; John Gavin Ketchen; Frances George Knowles-Foster; Lieut.-Commr. E. Ryder Large, D.S.O., O.B.E.; Alfred Herbert Larkman; Mrs. Aubrey Le Blond; Lieut. Albert Lennox, S. & T. Corps; F. B. Lewis; Colin Coningsby Watson Liddelow; Lieut.-Colonel Frederick Hamilton Lister, D.S.O., R.A.; Captain H. Alan Lloyd; Alexander H. Low, M.A.; Edward John Lusby; Arthur Woodroffe Manton; James Cyril Marsh-Edwards; Philip Mond; 2nd Lieut. Roderick Charles Murchison, 2nd Northants.; Douglas Newbold; John George Nicholls; Captain E. W. C. Noel, Indian Political Dept.; Lieut.-Colonel J. H. Owen, Northumberland Fus.; Frederick B. Parsons; Norman M. Penzer, F.G.S.; Ernest Platt; James Burton Pond; Russell Hobbins Porter; Robert F. Prain; G. H. Preston; Captain F. H. Robinson, D.L.I.; Harold Percy Rowe; Geoffrey St. Aubyn; Captain A. E. W. Salt, M.A.; George C. Sanderson; Lieut. H. de Savigny-Bowen, R.E.; Joseph Scattergood; Prof. E. H. Lewis Schwarz; Ikbal Ali Shah, M.R.A.S.; Lieut.-Colonel A. A. Sharland, D.S.O., E. Lancs. Regt.; Neville Alexander Dyce Sharp; Clive Sheppard; Captain Reginald Smales, M.A., 7th Northumberland Fus.; Major B. Smythies, R.E.; Edward Copeland Snelgrove; William E. Souter; Arthur Hood Spiers, M.A.; Frederick Robert Stewart; Mrs. Stewart; Harold Edward Storey, B.A.; George Ogilvie Sutherland; Miss Florence A. Thomas; William Thompson; Charles Archibald Walpole; Ernest Lee Walter; Captain Allan Watson, D.S.O., R.A.M.C.; Rupert E. Way; A. J. Wickwar; F. Williamson; Lieut. W. F. Willis, R.A.F.; Lieut. W. H. Winter.

PAPER: A Recent Journey in Liberia. Sir Alfred Sharpe, K.C.M.G.

Third Evening Meeting, 1 December 1919.—The President in the Chair.

ELECTIONS: Henry Dawson Beaumont; Captain Percy Morgan Brett, R.A.M.C.; David Buttle; Lieut.-General Sir Alexander Stanhope Cobbe, V.C.; Captain Cyril Roper Pollock Diver; Captain Armitage L. Forbes; Lovat Fraser; Mrs. Fraser of Relig.; Major C. R. Hay; Captain Charles Jewell, R.F.A.; H. J. C. Macarkness, B.A.; Rev. F. R. Mills; Russell Porter; Commr. Maxwell Barcham Sayer, R.N.R., C.B.E.; Major E. G. Sotham, M.C.; Miss Patricia T. W. Tufton; Alfred Charles Vowles; George William Young.

PAPER: The Cape-to-Cairo Railway and Train Ferries. H. Wilson Fox, M.P.

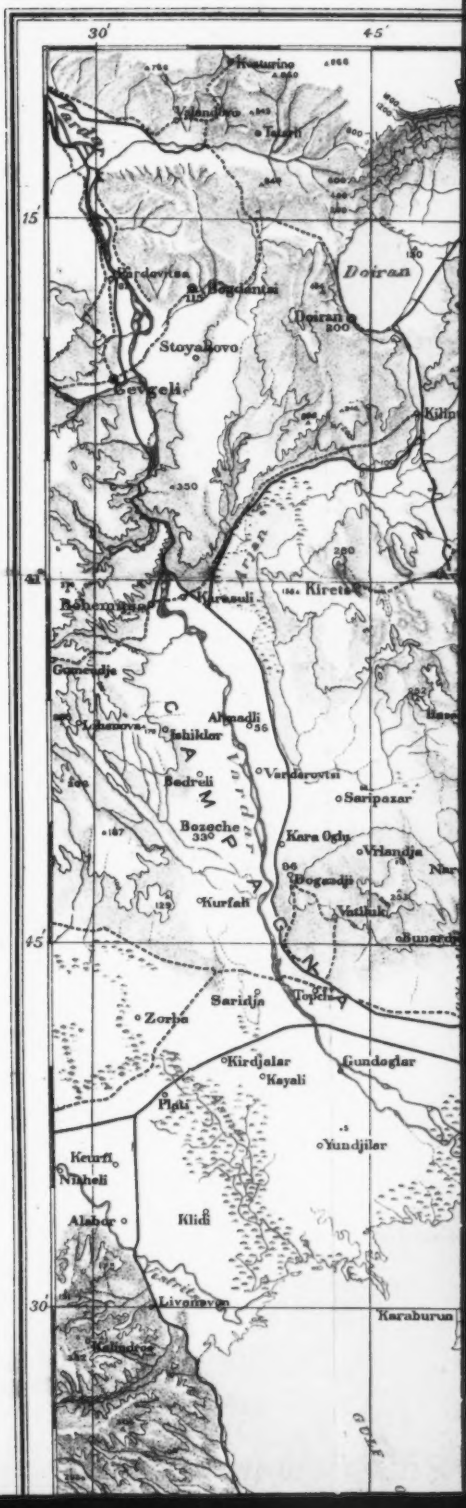
Fourth Evening Meeting, 15 December 1919.—The President in the Chair.

ELECTIONS: Sir Gilbert Thomas Carter; Harold Frederick Dunning; Lieut. Charles Victor Groves, R.N.R.; Rev. William Richard Harvey; Mrs. Laetitia Caroline Poyton Jones; Ernest Clarke Myring; John Charles Parkin; William John Waterman Roome; Charles Sherratt; Herbert E. Sieveking; Lieut.-Colonel Harold J. Solomon; Commr. Henry Stockwell, D.S.O., R.N.R.; Tudor Gordon Thomas; Captain Cyril Frederick Upton.

PAPER: In Northern Anatolia, 1917. Captain E. H. Keeling, M.C.

Second Afternoon Meeting, 8 December 1919.—The President in the Chair.

PAPER: The New Inch and Quarter-Inch Maps of the Ordnance Survey. Lieut.-Colonel W. J. Johnston, C.B.E., R.E.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Saripazar
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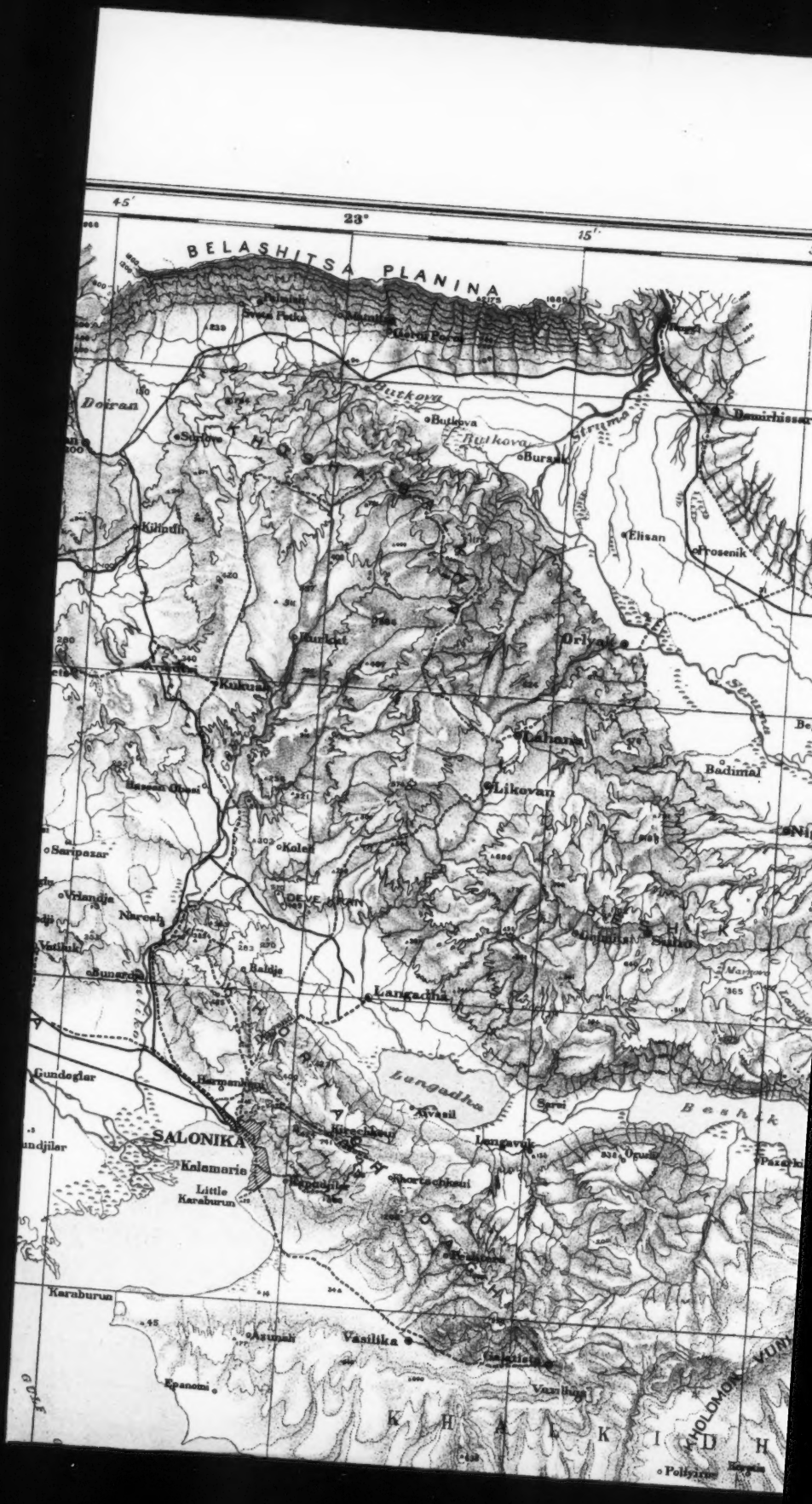
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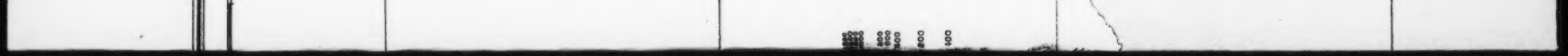

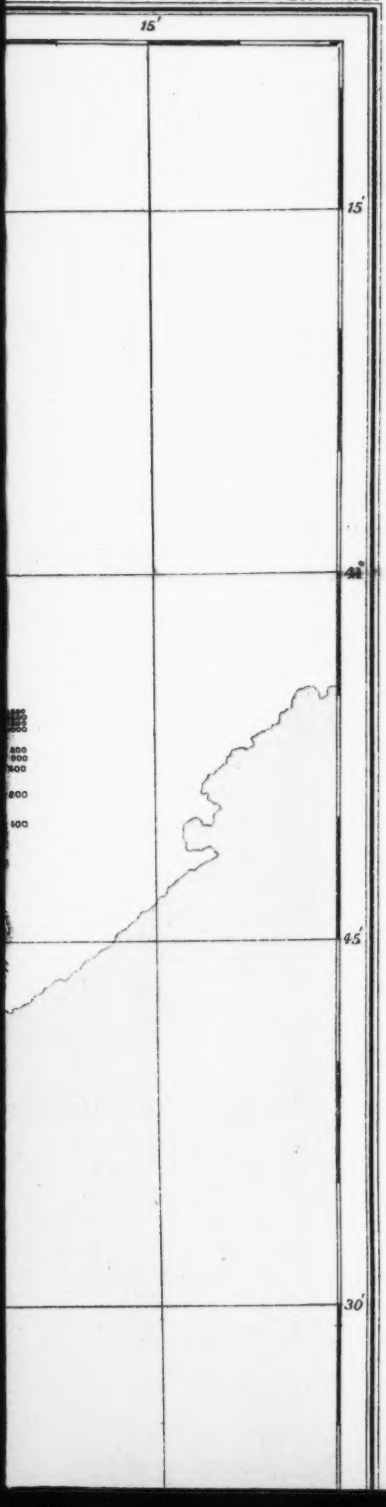
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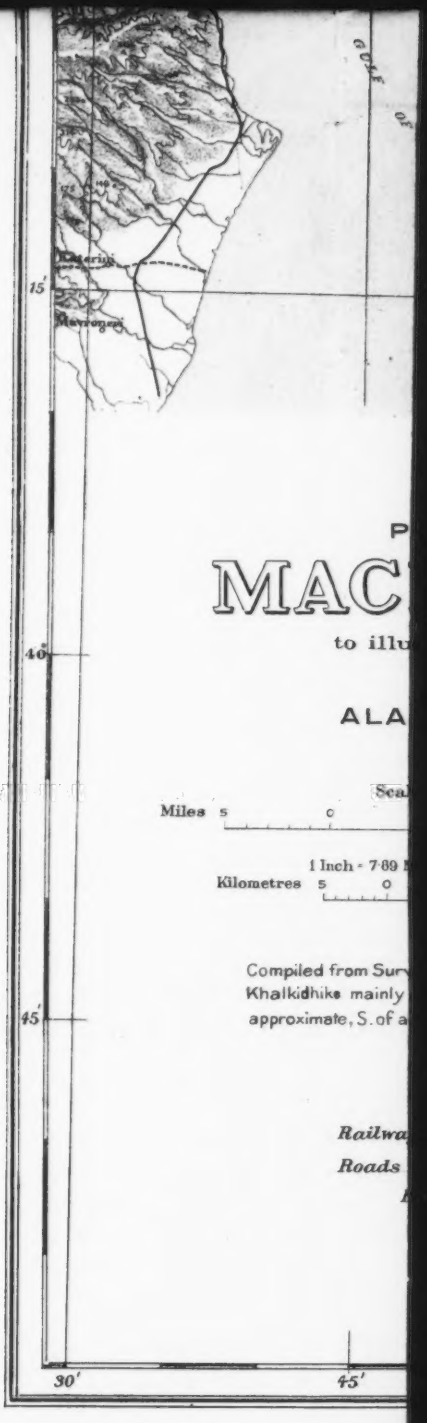

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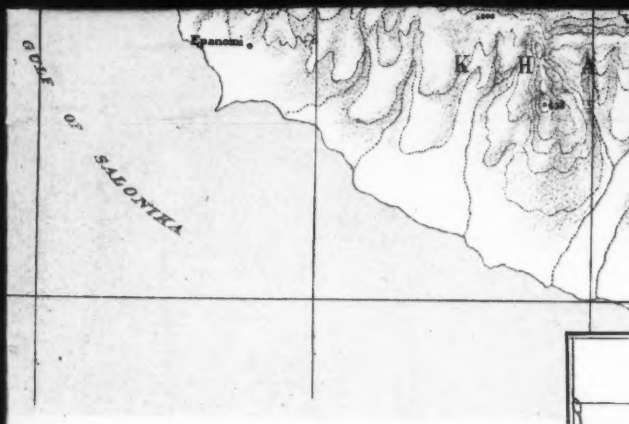

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to illustrate the paper

by

ALAN G. OGILVIE.

Scale 1/500,000 or 2/M

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From Surveys by British and French Armies.
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Reference

Railways .....

Roads .....

Heights in Metres

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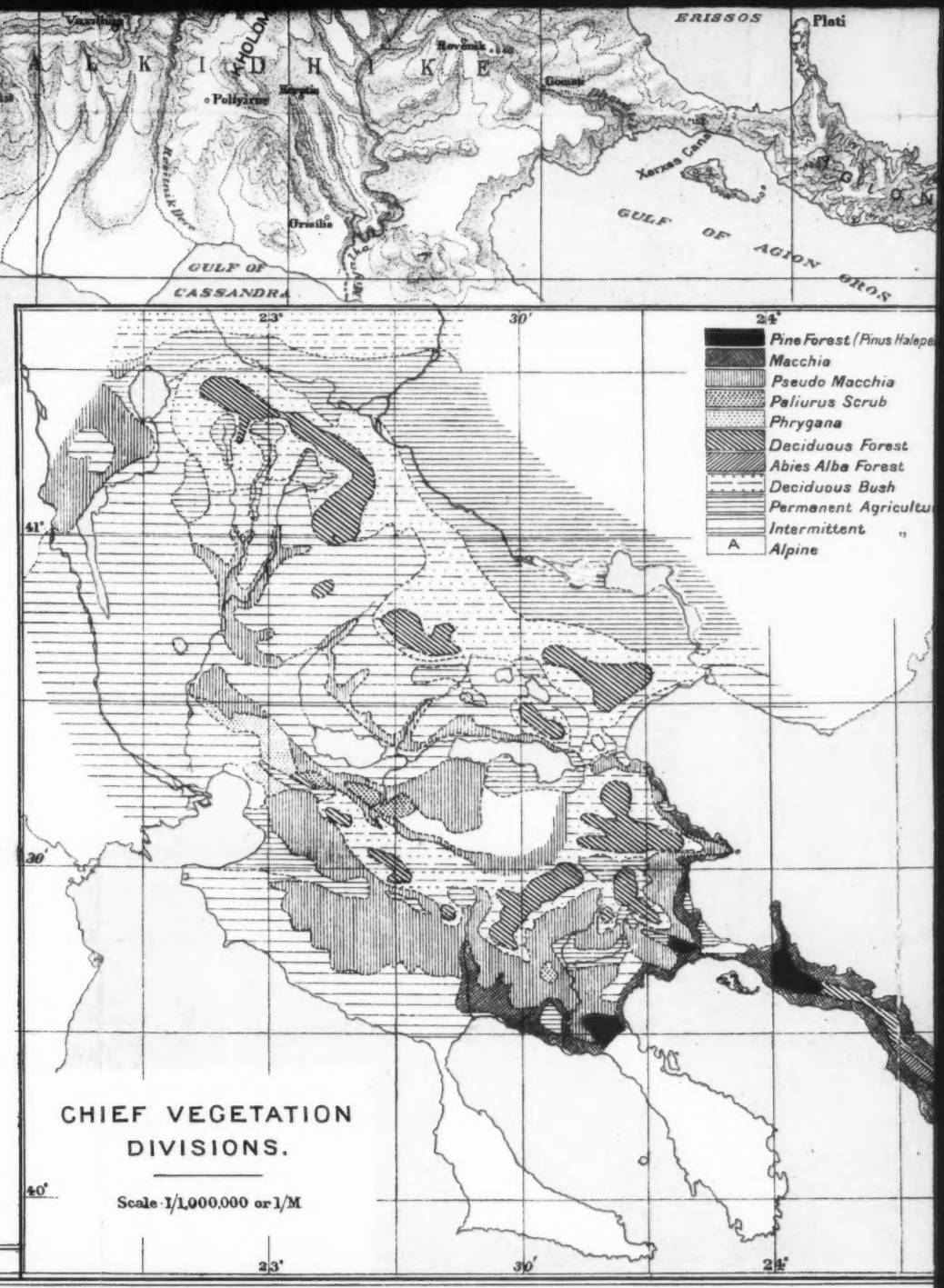
Published



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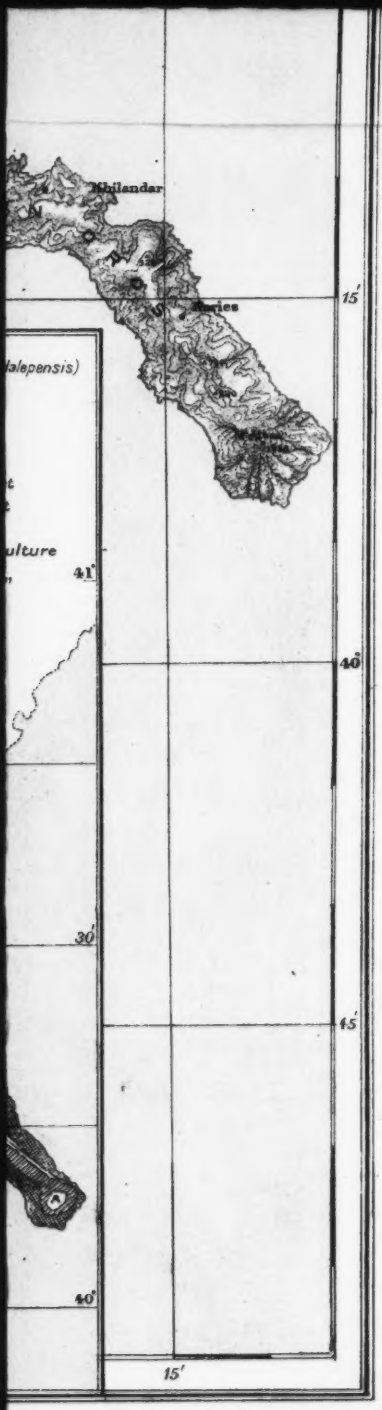

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Ogilvie.